***Public Policy Ideals and Commercial Results*—Operation of an Ohio Interconnected System, Central Station Data and Statistics, Together with the Regular Departments**

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Dangers in the National Electrical Safety Code

THE problem of fixing standards of electrical safety in the United States differs from that in any other country. Indeed, it involves two problems—first, the detail solution of scientific and engineering questions, and, second, the problem of administration with the factors of national individuality to consider. Geographical extent alone introduces elements which make standardization of detail practice next to impossible. The great variations in density of population modify the requirements of local standards in a most practical way. The differing political temper of local governing bodies hampers intelligent administration. All these generalizations have their individual applications when a national standard is put to test in any given situation.

Standards for the guidance of the industry have not been lacking in the past. The national electrical code applicable to fire hazards has been in existence for years, and committees of the various national associations have helped to standardize construction by codifying what has been agreed upon as the best engineering practice. From one point of view, therefore, the national electrical safety code, promulgated by the Bureau of Standards at Washington, is a natural development of a fundamental principle that has long been recognized. The work that Dr. Rosa and his assistants have so sincerely carried forward, however, departs from precedent in laying down not only broad safety standards which may be worked out locally to meet conditions but in trying to interpret in advance how to apply the safety standards locally by laying down operating rules to insure such application. The chief objection to the code centers around these details. If this fly could be removed from the ointment the code would be more effective in law. In many detail instances the code would serve its purpose in stating what is required, leaving the utilities and local authorities to determine the best means of meeting the standard.

There can be no disagreement with the motive behind the code—the elimination of life hazard to employees and public. But now that the code is to be put on trial the dangers in its general application should not be overlooked.

It has been pointed out many times that the code has no legal status. This is true. But there is little question but that when published with the approval of a federal body with the reputation of the Bureau of Standards it will have the moral effect of law. In this lies a danger. For the broad reasons cited above the code must necessarily be a compromise in many cases. Since there are sincere differences of opinion on details among those well versed in electricity, the opportunity for unfairness arising from mere ignorance on the part of those in authority locally is most evident.

During the coming year the code will be adopted, with or without modifications, by state commissions and local municipal bodies and by them administered as law. Then it will meet the test of the dangers outlined. The code, of course, will never be firmly established until passed on by the highest court. There the judgment and experience of the industry will carry great weight. Needless to say an adverse ruling on some detail of the code would react against the code as a whole.

The International Electrical Commission

PRIOR to 1904, the year of the International Electrical Congress at St. Louis, international actions among electrical workers were confined to congresses, convened on the occasion of some world's fair. Between the date of the first British Association Committee meeting on electrical units, in 1865, and the St. Louis meeting of 1904, a good deal of international work had been accomplished in this way. But it became evident that a continuously operative mechanism was necessary in order to carry on the work effectively. It was, therefore, voted at St. Louis to inaugurate a permanent International Electrotechnical Commission. Thanks to the untiring efforts of Colonel Crompton, the I. E. C. was started in 1906, with a secretarial office in London. At the last meeting of the I. E. C., in 1913, no less than twenty-four nations were represented, and some ground had been covered while much more had been prepared.

The outbreak of the world war, in August, 1914, necessarily dislocated the work of the I. E. C. Nevertheless, individual national committees have continued in existence, carrying on certain portions of the work, and, after the restoration of peace, the need for international co-operation in electrical matters should be no less than before. C. le Maistre, the general secretary of the I. E. C., is now visiting this country as a delegate to the standards committee of the A. I. E. E., from the engineering standards committee of Great Britain, in order to aid in harmonizing the electrical engineering standardization rules of America and Great Britain. About a year ago Messrs. Hobart and Skinner of the A. I. E. E. committee, paid a similar visit to the British committee in London. The result of this exchange of visits overseas between the two electrical engineering standards committees has been, as we are informed, to establish substantial conformity between the electrical standardization rules in the two countries.

There are at least two important functions which the international electrotechnical commission can fill. The first is to establish international rating rules for electrical machinery, whereby the rating of a machine can, by its physical characteristics and performance, be easily and conveniently determined in any part of the world. It is not desirable to standardize the details of construction of apparatus all the world over. On the contrary, each country and every factory should be encouraged to develop its own designs. But it is very desirable that the international rating of all machines, however designed and constructed, should be uniformly and equitably established, by tests, according to accepted standards.

The second function of the I. E. C. is to harmonize and unify the terminology, symbology, units and standards of electrical engineering, for the benefit of civilization, simplicity and mutual understanding. We therefore earnestly hope that, after peace shall have been re-established, the work of the I. E. C. may receive fresh impetus. Already, we owe to it a list of international symbols, a list of international terms, a standard direction of vector rotation, and an accepted list of permissible hottest-spot temperatures in machinery. The basis of a uniform international rating is already in sight; so that a 100-kw. machine, of a certain type, will retain an international rating of 100-kw. wherever it goes; which is a condition not met at present.

Reports from Iowa Stations

SPECIAL interest is attached to the data compiled by the Iowa Section of the National Electric Light Association which we publish this week, on account of the fact that they deal largely with stations ranging from rather small to moderate ratings. Detailed reports from many big stations are available, but general data covering conditions in the ordinary community are comparatively rare. The plants in the Iowa report are divided into groups with respect to the population served, and the study of these gives some remarkably instructive information, particularly in showing the economics of the situations. The first group includes communities averaging only a little more than 1100 in population. A noticeable point here is that people in small Iowa communities patronize electric service, the proportion of consumers to population being greater than in the groups formed of much larger communities. The gross income per capita is actually larger on the average than in the case of any of the other groups, and the income per kilowatt of rated capacity is well up in the list, being exceeded only by the same item in case of the next larger group of plants in communities averaging about 3000. The gross income per kilowatt-hour sold, too, is conspicuously higher. All these facts show the enthusiastic support which small communities really give to those who try to serve them. Another interesting fact is that the investment per capita is, upon the average, less in these little stations than in the bigger ones.

The other side of the picture, however, shows up in the percentage of operating expense to gross income. The figure for the small plants is 72 per cent, which tapers off for the bigger systems. In the group including the largest stations, serving an average population of nearly 44,000, the figures drop to 50.8 per cent. The grand average of all the commercial stations shows earnings last year of $6.43 per capita and operating expense of 65.5 per cent. The operating load factor indicates, as might be expected, the advantage of size. The group of small plants averages only about 22 per cent, as against slightly more than 30 per cent for the large ones. The difference, however, is not as great as appears to be indicated. The place where the little plant falls down is in its relatively high labor cost and high cost of production due to working on a small scale, generally with rather inefficient stations. It is such conditions which have gradually caused the consolidation of small plants into working networks able to be served from one or two efficient generating stations and requiring a minimum amount of station labor, while gaining in load factor and diversity factor. The municipal stations form an interesting group for comparison with plants of similar size under private operation.

The number of consumers in proportion to the population is almost the same in the two classes, and so is the gross income per capita. The investment per capita is slightly less in the municipal stations, and the gross income per kilowatt-hour is very nearly the same. The operating load factor is not quite so good in the municipal stations, but the ratio of expense to gross income in per cent is just about the same, the municipal plants averaging 66 per cent, and those of the three comparable classes in the commercial stations being 72, 66.8 and 59 per cent. All in all, there is a surprising similarity in the general performance recorded which extends even to the test of production expense per kilowatt-hour. The data speak well for the administration of the Iowa municipal stations. The report as a whole discloses extremely practical statistics regarding the performance of plants taken as they come, operating under all sorts of conditions, and representing in the main comparatively modest output.

The Effect of Vacuum Fusion Upon the Magnetic Properties of Pure Open-Hearth Iron

THERE are certain physical properties of metals that seem to be associated with the degree of metallic purity, and which cannot at present be secured in any other way. Prominent among these are the electric conductivity of copper and the permeability, or magnetic conductivity, of iron. By no treatment yet discovered can alloying copper be made to improve its conductivity. On the contrary, alloys possess a relatively low conductivity, and for the maximum conductivity one must look to the purest samples of the metal. Similarly, the permeability of steel alloys is low relatively to the permeability of pure iron. Indeed, it has been shown in recent years that the permeability of pure elec-

trolytic iron can be markedly improved by melting and refining it *in vacuo*. This probably means that occluded gaseous impurities lower the maximum permeability and at the same time increase the magnetic hysteresis loss.

In a recent article of *Metallurgical and Chemical Engineering*, abstracted in our Digest this week, Prof. T. D. Yensen publishes some researches, tending to show that it is not necessary to employ electrolytically pure iron in order to have its permeability increased by refining in a vacuum. Good results in the same direction have been obtained with open-hearth steel refined *in vacuo*. The improvement is not quite so great as has been obtained with electrolytic iron; but open-hearth steel can be obtained commercially with less than 0.25 per cent of impurity. The vacuum refining process reduced the coercive force of the open-hearth steel samples tested to less than one-half and increased the permeability about threefold.

Assuming that the vacuum remelt acts by removing gaseous impurities, it is still uncertain as to the way in which the higher permeability is produced. A tentative explanation, however, lies in relation to the Ewing theory of metallic magnetization, by considering that the removal of the occluded gas makes the alignment of the magnetic molecules more nearly uniform; while at the same time diminishing their frictional resistance to being rotated. Consequently, after refining, a smaller value of reversed η can serve to swing the magnetic molecules around their axes into reversed positions.

Whatever may be the actual *modus operandi*, it would seem that any simple process for increasing μ and diminishing η in sheet steel would be a boon to the designing engineer.

The Small Network

VERY much to the point in connection with our comment on the report from the Iowa stations is the account which we publish of the transmission and distribution system of the Ohio Service Company. This is one of the many networks that have grown up all over the country, doing sterling service in furnishing electric light and power to scattered communities, in many cases too small to support individual plants. The Ohio Service Company's network is instructive in that it covers a section that has been particularly well canvassed for new business with very gratifying results. Nineteen communities altogether are served. The largest of these are Coshocton, New Philadelphia and Cambridge, which contain the generating stations. The transmission lines from these points join, forming a star-shaped distribution system to which the other load points are connected. The Ohio distribution system differs from some recent networks, in which the tendency has been toward the consolidation of the generating plant at a single point. In this instance, however, two small hydraulic privileges are utilized which give reason for maintaining separate operation, but beyond this casual circumstance a broader way of looking at the matter in evidenced, at present at least, which points toward the desirability of more than one generating station for the network. First, it is not well to put all one's eggs in one basket, particularly when a comparatively small accident, say on the switchboard, may put the entire station out of business perhaps for several days or weeks. Second, in the long run the distribution losses cannot be forgotten, representing a serious part of the expense of service. And it often is true, as it seems to be in this case, from the distribution of load that the existence of several generating stations means a less average distance of distribution and, on the whole, less average cost of production, the distribution losses tending to offset the gains that might be reached by a consolidated central station. In our judgment this condition exists much more frequently than engineers generally think, so that consolidation may mean an actual loss in the cost of power delivered to the consumer, instead of showing a gain owing to the lower busbar cost of the large station. On this system provision has been made, however, for a large central plant if the time arises when it may be needed.

The substations of the system, except those used in connection with synchronous converters, are entirely of the outdoor style, a fact which we emphasize once more to call attention to the large amount of money that has been wasted in putting up formal substations where there is no load to speak of and no need of much attention. Some valuable data are given on the cost of these substations operated at 13,200 volts and 33,000 volts. The cost of the structure for a 150-kw. station was $158 which, together with the equipment, including everything, made the total cost $12.32 per kilowatt. For a 300-kw., 33,000-volt substation the cost for structure was $185, with the total expense $10.45 per kilowatt. These figures we call to the attention of engineers who have felt it necessary to put up brick and tile substations to impress the bondholders. This Ohio system is distinctly built for business, and business apparently it is getting in gratifying quantities. It pursues the policy of distributing its own energy, of co-operating with manufacturers whom they at present serve, or may serve, and of following up a house to house campaign for light and appliances.

The Coming Issues

Next week, in the second or station operating number for June, practical operating articles will treat of installation costs for industrial plant substations, methods of working on live high-voltage lines, and the use of electricity in large contract work. Other articles and the usual departments will present topics of interest to the central-station man, contractor, dealer and jobber, including a timely comparison of the economies and operating costs of electric and gas water heaters. In the engineering number, dated June 17, a leading article will describe the measurement of high voltages by means of the corona voltmeter, and another contribution of interest to engineers and operating men alike will outline methods used to maintain the high dielectric strength of transformer oil.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Promotion of Electric Cooking

Discussion of Report of Electric Range Committee of N. E. L. A. Brings Out Helpful Ideas From Central Stations and Manufacturers

Owing to the limitation of space in last week's issue of the ELECTRICAL WORLD it was not possible to touch upon more than briefly what was probably the most important topic before the Commercial Section meetings of the National Electric Light Association Convention held that week in Chicago, namely the development of the electric range and the ways and means for making it a common household article.

The electric range committee report, which was very complete, has been printed and an abstract will be found on page 1228 of last week's issue of the ELECTRICAL WORLD. The discussion to which it was found necessary to devote an extra and separate session was lively and to the point, being participated in by representatives of both central stations engaged in actively promoting electric cooking and representatives of electric range manufacturers. Since it will probably be two or three months before the association members will receive printed copies of this discussion, an account of it is given below.

H. W. Alexander, publicity manager of the Society for Electrical Development, opened the discussion, stating what the society would do in co-operation with the Commercial Section of the association to promote the sale of electric ranges and in regard to national advertising. Among other things the society will prepare (1) a handbook containing the best selling suggestions that it is possible to obtain at the present time; (2) sales bulletins on selling plans that have been found successful in different communities, and (3) a neutral booklet exploiting electric cooking for the education of prospective customers. In addition the Society will incorporate in its regular routine of publicity on electricity articles, new matter, etc., for newspapers and national periodicals on the electric range, its possibilities and use.

Standard Type of Range Advantageous

A. W. Childs of Los Angeles read some notes prepared by S. M. Kennedy of the Southern California Edison Company, who was unable to attend the meeting. In the opinion of Mr. Kennedy it would be advantageous to have a standard type of range. For average requirements the central station should provide a three-burner type with two elements in the oven above and below and a warming oven. It is to advantage to have a plug placed in the side of the range, to which any lamp socket appliance may be attached, thereby enlarging the capacity. Both the open type and the closed type of burners have their advantages. The majority of new users favor the open type, but the closed type is more durable. Installation expense, which is high enough under the most favorable circumstances, should be kept to a minimum, and central stations, for the present at least, should make the installations. Moreover, during this period of promotion the central stations should do the range selling.

The difficulties mentioned in the report Mr. Kennedy disposes of briefly. First cost is obviated to a considerable extent where the central station sells and installs at a minimum margin of profit. The anticipated high operating cost is a matter of education—showing the consumer the compensating advantages. Lack of economical heating facilities is not as great as anticipated. Slow operation will be overcome by larger burners, which will tend to diminish rather than increase the bills. Skepticism and lack of confidence also is a matter of education. Each central station must work out for itself the problem of disposition of old equipment. Satisfaction with present means of cooking will give way to progress. Where kitchens must be heated during the winter, the electric range can be used during these months as an auxiliary if the minimum conditions are not burdensome. Any method of merchandising that brings results without an extensive outlay is all right.

Accumulation of Hot Water at Top of Tank

In connection with having an additional receptacle attached to the range Ralph J. Patterson of Waterville, Me., suggested that it be done in connection with wiring and at an extra expense, explaining to the customer that his flatiron would then be using energy not at lighting but at cooking rates. In regard to electric water heaters, it was his opinion that the immersion type of heater is sufficiently efficient for all practical purposes. The solution of this problem lies in the efficient application of heat. More energy is wasted, whether or not the tank is lagged, by trying to keep hot water in storage than would supply the customer with all of the hot water he needs. The heater must be of sufficient capacity so that the water delivered will, when circulated, be actually accumulated in the top of the water tank at what he termed the "working temperature"—namely, the bath temperature.

L. B. Gibbs of Boston, Mass., followed with some pertinent remarks regarding methods of electric range advertising which have been successful in his territory. For local advertising he found it best to use newspapers that go into the home and where there is leisure time for reading them, namely, Saturday afternoon papers and Sunday papers. Excellent results were obtained by using the classified advertising pages devoted to real estate. His method of attack is, first, directly upon the real estate dealers and building contractors, stimulating their interest. Letters go periodically to these people, stating what his company is doing and soliciting suggestions which frequently prove to be profitable. In connection with building contractors, advertisements are run devoted entirely to the builder's development with but a display line at the end reading "All equipped with electric ranges furnished by ———." In small type appears "The Edison Electric Illuminating Company of Boston, sixty styles, fifteen manufacturers; from $20 up." Builders of new houses are reached and prospects are invited to range demonstrations, to whom also are mailed copies of the advertisements run for the building contractors. In addition, street car advertising has been found to be effective.

Mr. Michel of St. Louis, Mo., brought up the question of co-operation with the dealers. In his city the central station has agreed to absorb up to $15 of the

dealer's installation or any bonafide sale of an electric range. While but about 2 per cent of the ranges sold in St. Louis are sold by dealers, a willingness, nevertheless, on their part to go after the business has been shown, and Mr. Michel advocated other central stations making a similar proposition to responsible dealers in their communities.

DEVELOPMENT ALONG LINES WORKED OUT FOR GAS RANGE

W. G. Stetson of Boston, Mass., advocated going after range business provided a satisfactory rate could be had, but he did not advocate trying for water heating business. The quality of the ranges should not deter the movement but the manufacturer should cooperate with the central station, correcting defects as found. He particularly pointed out the way in which the gas industry promoted the sale of gas ranges when they first came out, and urged the electrical industry to emulate the gas industry. Advertising expenses for promotion should not be checked against the first year's expenses but should be prorated over the period affected by that advertising. In speaking for Mr. Hale he said that rates were local problems and should not be a subject for discussion at that time. He further offered on behalf of Mr. Hale the co-operation and help of the rate research committee.

E. J. Conley of Indiana brought out some points collected from the recent Indiana convention. The educational feature must be developed before people can be induced to use electric ranges. He stated that some manufacturers' representatives have tried to introduce ranges by attacking existing rates as too high. This he considered very unfortunate because most of the Indiana towns are small and expenses high. No ranges were sold, and the only effect was to arouse a bad feeling among the public against existing rates.

S. W. Borden, Summit, N. J., believed that it is inadvisable to place fuse plugs on the different elements. He suggested that it be recommended that manufacturers install on every range a lug for grounding the frame of the range, and also that all ranges be wired interchangeably for two or three-wire service. He had found contractors furnished with a range for window display to be good boosters.

R. B. Snyder, Milwaukee, Wis., stated that no ranges in his city have been returned after a trial period, because once a range was installed his company had range experts looking after it continually until the user became efficient in its operation. He advocated high-priced ranges as being more efficient. The type of element he found to be a matter of education. Most women preferred the closed type because it looked more like the coal range to which they had been accustomed.

MANUFACTURERS' PROBLEMS

Mr. Kileen spoke from the standpoint of the manufacturer, telling of the problems from the selling standpoint with which the manufacturers are confronted, namely, advertising, furnishing expert sales help, demonstrators, prices and discounts. With large lists and large discounts the manufacturers will give first-class quality. With low prices the quality will be low.

Mr. Hughes, another manufacturer, stated that he believed it absolutely essential that every range should be individually fused. He was not in favor of putting a lamp socket receptacle on electric ranges.

C. S. Walton, Los Angeles, Cal., stated that his company is getting wonderful results on water heating by a combination of the solar and the electric heater. The difficulty of a double-acting thermostat, he thinks, is being solved. He advocated the lagging of the entire hot water system in all new houses. As a refutation of what he called the "bugaboo of introductory expense" he cited the development of the field for lamp socket appliances. In connection with rates for apartment houses his company is making a combined rate to the apartment houses furnishing a master meter with submeters.

Mr. Booth of Ontario, Cal., stated that the manufacturers are now pretty well choked with orders, but that this condition would not always exist. He suggested a campaign to induce other central stations to adopt a range rate, pointing out that prices will come down as production increases.

Mr. Gillarney of Texas stated that in his section of the country many water heaters are in operation throughout the year, and no great difficulty is found in obtaining this load. No water heaters are sold separately, only in connection with range installations. He advocated enlisting the co-operation of the installment houses as a means to combat high initial first cost.

W. R. Putnam of Salt Lake City, Utah, chairman of the electric range committee, closed the discussion. In regard to water heating he said that this work is not as well advanced as the range work. The sub-committee on water heating, he said, is inclined to think that possibly the proper solution is a 2.5 or 3-kw. heater working just the same as a gas heater works, taking ten, fifteen or twenty minutes to get hot water for dish-washing or the bath. If a small heater is used the flow of the water should be restricted so that the hot water is in the top of the tank. Good results will be had if the dealer can be persuaded to talk ranges, even if he had to be paid something for it. The dealer will be a booster if he is shown what he will get out of it. Manufacturers should watch over-enthusiastic salesmen and curb any activities such as Mr. Conley spoke of in regard to combating high rates.

Large Chicago Turbines Now Under Test

The 30,000-kw. 9000-volt 25-cycle horizontal turbo-generator recently installed at the Northwest Station of the Commonwealth Edison Company and now undergoing acceptance tests, attracted considerable attention during the N. E. L. A. convention in Chicago. The tests are being conducted by Sargent & Lundy, consulting engineers for the Commonwealth Edison Company and by engineers of the General Electric Company. Tests have already been made at loads of 10,000, 20,000 and 35,000 kw., and it is understood that the steam consumption per kilowatt-hour for all loads will be considerably below the guarantee.

N.E.L.A. Convention Aftermath

Looking back over the annual convention of the National Electric Light Association, held in Chicago last week, certain features stand out pre-eminent from the mass of detailed activity.

Within the short space of three and a half days there was presented at more than twenty sessions some 2500 printed pages of material in the form of reports, papers and addresses. This is almost two times as much as was presented at the convention held last year in San Francisco during the Panama-Pacific International Exposition, and was far in excess of any previous convention. The nearest was probably the Philadelphia convention held two years ago, but the mass of material presented this year was more by hundreds of pages.

One reason, of course, for this exceedingly large amount of material was the inclusion in the association of the Electric Vehicle Association.

This immense mass of material was considered, although it is not fair to say digested, in some twenty-three sessions, representing about five items per session.

In spite of the fact that there was such a great mass of material, many authors insisted on reading their entire report or paper, as the case might have been, although each report was accompanied by a sufficiently comprehensive abstract.

The amount of discussion was far in excess of that for any previous year. It is estimated that the discussion amounted to in the neighborhood of 500 pages of printed matter.

For the first time during any convention of the association there were four sessions going on at one time.

The attendance was remarkably good, especially at the technical sessions. A room with a capacity of 500 was found at times not to be large enough to accommodate those wishing to attend the session. The accounting sessions frequently had an attendance of more than 250.

It was at first thought possible to distribute all of the convention papers to all of the membership before the convention and the discussion shortly afterwards. It was, however, found impossible to do this, so that the members have so far received only an incomplete set of papers and reports. The remaining ones, it is expected, will be distributed immediately, while the discussions will follow three or four months later.

Discuss Utility Taxation at Oklahoma Convention

Principle of Taxation Analyzed—College Professor Favors No Taxation—Discussion Lively

Favoring no tax on public utilities because such taxes are always shifted, Prof. J. W. Scroggs, director of the extension division, University of Oklahoma, presented a paper on "Taxation of Public Service Corporations" before the fifteenth annual convention of the Gas, Electric & Street Railway Association of Oklahoma, held at the Lee Huckins Hotel, Oklahoma City, on May 23, 24 and 25. In his paper, which was an excellent analysis of the taxation principle, Professor Scroggs expounded the theory of non-distributable taxation. Always tax that which can be taxed, he said, without shifting the tax, such as taxes on inheritance, unearned increment of land and incomes.

Regulation of rates, he said, was a sufficient taxation. The combination of rate regulation and taxation is too great a burden. It will squeeze the life out of public utilities. At the present time such bodies as tax commissions present the only solution of the difficulty. The per cent systems of taxation now in vogue tax truthfulness and reward prevarication and dissemination.

There followed the reading of this paper a lively discussion in which the following took a prominent part: Galen Crow of Guthrie; F. W. Insull and George W. Knox, both of Oklahoma City.

At the afternoon session of the first day, A. J. Neff of the American Public Service Corporation, Abilene, Tex., read his paper entitled "Fuel Efficiency," bringing out some very interesting discussion, especially that of Mr. Jordan of the San Bois Coal Company, who stated that economy begins with the method of mining. The ultimate solution of the coal problem is the burning of pulverized coal, he thought, while the sale of coal should be on the basis of heat content. This was the first time in Oklahoma that a coal company offered the heat content basis for coal purchasing. Others who discussed this paper were L. G. Purtee and G. W. Knox of the Oklahoma Railway Company, Professor Morrow of the University of Oklahoma, and J. K. Stanley, manager of the Municipal Electric Light & Water Plant of Tonkawa.

"Washday—Yesterday and To-day" was the title of an illustrated paper presented by Mr. Talmage of the Western Electric Company, in which he discussed old and new methods of washing clothes and economy of electrical washing machines.

W. R. Molinard, general manager of the Oklahoma Gas & Electric Company, Oklahoma City, read a paper on the subject "Publicity Towards the Promotion of Harmonious Relations Between Public Utilities and the Public." It was brought out that a company's record will reflect its policy.

Rather long and detailed discussion followed the paper on "Diesel Oil Engines," by Prof. L. W. W. Morrow of the University of Oklahoma. George W. Knox, general manager of the Oklahoma Railway Company, Oklahoma City, brought up the question of Diesel engines for railway substations. J. H. Felgar of Norman made some comments on thermal efficiency of the Diesel oil engine as worked out from Professor Morrow's data. Some of the principles that now obtain were discussed with illustrations by Mr. Pollister of the Busch-Sulzer Company. Tom F. Carey, manager of the Norman Milling & Grain Company, also entered this discussion.

W. G. Ashton, commissioner of labor for the state of Oklahoma in his address on "Safety First" stated that it was the place of the industrials to lead the safety-first movement. Make safe men as well as safe equipment, he urged. Begin with the child. Considerable detailed discussion followed, in which Professor Morrow suggested that posters be placed conspicuously near places of probable accidents picturing what might happen at that place if proper care was not taken.

There was a lively discussion of the paper on "Development of New Business," by R. K. Johnson, secretary-treasurer of the Washita Power Company, Pauls Valley, in which the following participated; W. P. Jones of the Oklahoma Gas & Electric Company, Mr. Terry of the Public Service Company of Oklahoma, F. H. Tidman, G. W. Knox and others. A. L. Mullergen of the Benham Engineering Company spoke on "Street Lighting Service and Contracts," citing the experience of Milwaukee in connection with a municipally-owned system supplied with metered service, and advocating the same in towns of 5000 or more inhabitants. Both Fred W. Insull, president of the Public Service Company of Oklahoma City, and Hugh J. Cooper, manager of the Municipal Electric Light Plant of Weatherford, offered objections. It was pointed out that such action would tend toward municipal ownership, and that under such conditions as advocated there would be two trying to operate one service. In the closing discussion H. V. Bozell of the University of Oklahoma suggested a constant charge plus an energy charge to eliminate the unfairness of low efficiency lamps on old contracts.

The following were elected to serve as officers for the ensuing year: President, C. H. Kutz, manager of the Okmulgee Ice & Light Company; first vice-president, Tom F. Carey, secretary-treasurer and manager of the Norman Milling & Grain Company; second vice-president, F. D. Shaffer, vice-president and manager of the Chickasha Gas & Electric Company; secretary-treasurer, H. V. Bozell of the University of Oklahoma.

R. K. Johnston, manager of the Washita Electric Power Company, and W. E. Blackwell, superintendent of the Afton Municipal Light & Water Plant, were elected to the board of directors.

The entertainment features of the convention included a luncheon given by the Nunn Electric Company, the annual banquet, a visit to the Ford assembly plant and a Jovian rejuvenation.

Final Hearing on National Electrical Safety Code

Representatives of the National Electric Light Association Do Not Indorse the Work of the Bureau of Standards, Although Its Work Is Commended by Representatives of Municipalities and State Commissions

AFTER preliminary hearings at the La Salle Hotel, Chicago, on Friday and Saturday of last week, what is said to be the final public hearing on the national electrical safety code promulgated by the Bureau of Standards of Washington, D. C., was held on Monday and Tuesday at the same hotel. Although Tuesday was a holiday, all of the sessions were well attended.

The general sentiment of the men representing the various electrical interests was that if the Bureau of Standards could control the administration of its rules, and could definitely order them changed or suspended, where the cases might justify it after the rules had been made mandatory in certain localities, there would be no objection to the issuance of the code. Representatives of the National Electric Light Association, the American Institute of Electrical Engineers and the Electric Power Club, however, pointed out that such control was entirely impossible. Objections were made not so much to the rules themselves as to the method of their administration.

Municipal inspectors and representatives of state commissions held the floor during most of the two day sessions and the evening session. To the commission and inspection department representatives, the rules as they now stand seemed to be in the main acceptable. Steam railroad men, electric railway men, telephone and telegraph representatives, although objecting in some cases to details, also seemed to be favorably impressed with the code. Dr. Rosa of the Bureau of Standards maintained throughout the right of the Bureau of Standards to issue such a code, although admitting that the bureau has no legal authority to enforce it. He said it was not the wish of the Bureau of Standards to foist a burdensome code upon the electrical industry, and that the code as finally amended represented the best co-operative work of the Bureau of Standards and the operating and engineering talent of the electrical industry. The rules in his opinion are reasonable and easily complied with. They will probably be printed and issued for trial some time in the summer after such specific suggestions as are thought fair and which may be received in writing up to July 1, have been added to them.

DEVELOPMENT OF THE CODE

Dr. E. B. Rosa of the Bureau of Standards, in speaking of the origin and development of the national electrical safety code at the opening session, traced the work of the Bureau of Standards from the time Congress gave it permission to investigate methods of reducing the life and accident hazard in the generation, distribution and use of electricity in July, 1913, to the present day. He told of the various hearings held in different parts of the country and of the results thereby attained. He said that it was early realized that an electrical safety code to be truly national must be based upon the experience and conditions of the entire country. At every hearing discussion and criticism of the rules were invited and every effort was made to learn the best opinions of the most experienced engineers and operators on the subject of safe construction and operation.

The code, he says, has been so drawn as to make it reasonably flexible in administration, and although the Bureau of Standards recognizes that it is not a perfect work, it believes it is not only the most complete but by far the best balanced electrical safety code that has ever been prepared. It is the hope of the Bureau of Standards that during the first year the code will be regarded as on trial, and that it will not be administered rigidly or in such a way as to cause embarrassment or unreasonable expense to any company.

HAZARDS SHOULD BE LESSENED

Dr. Rosa asked the same splendid co-operation in the adoption and use of the code that has been shown in its preparation. It should now be adopted in practice, he said, and further developed and improved by the experimental method. The interests of those who are to observe it, he claimed, are sufficiently safeguarded so that with an intelligent administration it will work out satisfactorily in practice. By co-operating with administrative authorities in its adoption and observance, a reasonable interpretation and administration is much more likely to be secured than if its adoption is opposed and its observance neglected. The public has an interest and responsibility in the matter that is nowhere questioned, and public utility companies and employers of labor think not only of the financial and legal aspects of safety problems, but of the moral aspect as well, and the question of the good name and greatest success of the electrical industry. The aim of the safety code is not to secure 100 per cent of safety, but to come just as near to 100 per cent as is practicable and reasonable. Gradually the standard can be raised. At the outset the aim is to require what is reasonable, and to recommend as much more as in any case seems practicable.

PROVISIONS FOR REVISIONS OF CODE

The Bureau of Standards expects to continue its study of the various subjects covered by the code and of the results of its application in practice, and will be glad to receive, from the various municipalities and commissions which may adopt it and from any company using it, the results of their experience. At the end of a year or thereabouts, a thorough revision will be made; the methods followed in the revision will be substantially the same as the methods followed in the preparation of the code, namely, that all interests will be consulted, information and suggestions will be received from any and all sources, and such conferences as seem necessary or desirable will be held.

Those who took part in the general discussion of the code following Dr. Rosa's remarks were: W. H. Blood, Jr., Boston; Farley Osgood, Newark; R. J. McClelland, New York; W. H. Merrill, Chicago; C. E. Skinner, Pittsburgh; R. H. Nexsen, New York; V. H. Tousley, Chicago; John Say, St. Louis; R. S. Hale, Boston; Ernest McCleary, Detroit; Dr. E. B. Rosa; H. S. Wynkoop, New York, and W. J. Canada.

POSITION OF NATIONAL ELECTRIC LIGHT ASSOCIATION

The remarks of Mr. Blood practically expressed the sentiments of the electrical interests outside of the inspection departments represented. What he said, therefore, is given quite fully.

"The aim of the Bureau," said Mr. Blood, "is a worthy one—to safeguard the lives of the electrical worker and the public.

"The aspiration of the Bureau to devise a code which will be universally adopted and become national in application, as well as in name is, to say the least, an ambitious undertaking.

"We fully agree with the aim of the Bureau for all of the electric companies are now and have now been for years trying to safeguard the lives of employees and the public.

"The ambition of the Bureau is a laudable one, but if carried out on the present lines we believe that it is impossible of realization, that is, the production of a single code, full of minute details, cannot be made to apply universally to this great country of ours with the varying climate temperatures and social differences.

"Theoretically, we believe that a single national code should be better than forty-five different codes applying in as many states. Electric light and power interests do not condemn a national safety code, but they do believe that if such a code is to find universal adoption it must be general in type; that to confine the rules to detail specifications will automatically prevent its ready acceptance.

"We believe that the Bureau has attempted an impossible task.

"There are so many factors that vary from state to state, even within the territory served by a single large electric light and power company that rules for proper universal adoption cannot be devised.

"Consider for a moment variations in temperature—some companies operate in the three zones—can proper allowance be made for this in a set of universal rules? Storms, wind, sleet, ice vary in different locations and an arbitrary division of the map, though based upon government records, cannot fairly differentiate for all conditions.

"The social characteristics of different communities certainly call for different classes of construction which cannot be taken account of in a set of rules. Many communities would be glad to get poor service rather than none where financial conditions do not warrant first-class service.

"Existing state laws which can only be changed by new legislation, present commission rules and regulations which oftentimes can only be changed after public hearings, all tend to prevent the adoption of specific rules. And finally an attempt to determine by definition indeterminate facts only serves to add to the confusion.

"Many of these variations have been considered in the proposed rules, while many others it is admitted are impossible of recognition.

"It is, I believe, the hope of the bureau that it may present a truly national safety code which can be adopted by public service and industrial commissions of the various states and by municipalities.

"Such a code it may be possible to devise, but we do not believe that the code which has been drafted is in such form as to lend itself to general adoption. There are but few commissions or municipalities that have adequate forces of inspection to see that such an elaborate code is lived up to, and there are some commissions whose inspectors would be embarrassed to attempt to explain the meaning of many of the rules. And this does not take into consideration the multitude of municipal inspectors who often have more political than engineering ability.

"If we could have as inspectors educated, trained and judicious men, like the members of the bureau for example, the utilities would not have much to fear in the reasonable interpretation of the rules. We do not believe that the Bureau fully appreciates the mediocre type of men, with exceptions of course, that will be required to administer the rules if they are universally adopted. The rules may be changed, we are told, to meet local conditions, but we fear that if this is done we will get a political and engineering conglomerate with its well-known inconsistencies and irrational conclusions.

"We do not oppose a national safety code in theory, but we cannot approve this type of a code.

"The code in its first draft was an impossibility. If enforced it would have put many electrical companies out of business or would have required a material increase in rates even to pay operating expenses.

"The Bureau very courteously invited the electrical interests to confer with it and to criticise its rules.

"I hope that the Bureau will not be offended when I say that the first impulse of the electrical interests was to have nothing to do with the original code, but the sober second thought of the electrical interests was to join with the Bureau in an attempt to see that rules were promulgated under which they could meet their operating expenses and which would not entirely stop development in sparsely settled districts.

"We realized that the Bureau was serious in its intent to get out the rules and so in the spirit of self-protection we found ourselves forced to co-operate. The Bureau will, however, admit, I think, that after we got under way our co-operation was active, constructive and serious. A rough estimate shows that we have already spent in time and expenses in the work in excess of $100,000 and the end is not yet. The Bureau has spent perhaps half as much in addition.

"At this point in my discussion I must digress from the main issue a moment to pay a tribute to the personnel of the Bureau. As educated physicists, as polished gentlemen, as careful investigators and as personal friends we would have to hunt a long time to find their superiors. In courtesy and in patience we have seldom seen their equal; and on account of all of these remarkable personal qualities, it makes it a most unpleasant task for me to criticise the results which they have accomplished.

"Nevertheless, from a business standpoint, the Bureau and the country at large should know that we are not satisfied with the code. The present draft is neither the ideal code of the Bureau, nor is it in accord with present standard practice—it is simply a compromise document—based partly on theory and partly on practice and as such is objectionable to many of the electric companies.

"On theory, it is in some cases ahead of the times and on practice it is lagging behind. One company will find some rules a hardship while another company will experience equal difficulty in complying with some entirely different rules.

"Standardization too early in a rapidly changing art tends to dull initiative. Rules too specific discourage experimentation. We are confronted with these very tendencies in several rules of the present draft.

"Even now, the rules, modified as they are, cannot be said fully to recognize present practice which has stood the test of years, but rather calls for requirements which we believe will call for large capital expenditures with little or no increase in safety.

"The development of standard safety rules is not essentially an engineering study—it is an economic problem. Many of the engineering features of the code have been well worked out, but the financial effects of the inforcement of the rules has apparently not received the same consideration as many of you know. I have the honor to represent officially the National Electric Light Association. At the present time as chairman of a committee appointed for their purpose and as a former president of the association, I know the policy of the association and voice the sentiments as authoritatively as any one man can. I also speak as a rep-

resentative of some forty operating companies which may be affected by the enforcement of this code.

"We have been asked for an expression of opinion of the code. I am glad we have not been asked to vote on the matter.

"In order, however, to clear the National Electric Light Association from any implied indorsement of the code or any tacit understanding that we approve any of the rules, I beg to make the public statement that we do not as individuals, nor as a committee, nor as an association, approve, endorse or ratify the proposed code nor any of its provisions.

"In conclusion let me say that we fully appreciate the magnitude of the task which the Bureau has attempted and we believe that the Bureau needs all the constructive help based upon experience that it can get, and we shall be glad to co-operate with the Bureau in the hope that ultimately a simple, clear and comprehensive code may be devised which will not alone protect the lives of public and employees, but which will tend to make safe the savings of the investor, will encourage the use and stimulate the development of what is even now regarded as the safest form of energy for producing light and power."

CRITICISMS OF A. I. E. E.

Farley Osgood, speaking for the American Institute of Electrical Engineers and many operating companies, said the A. I. E. E. cannot and does not indorse the code. To be adopted by the American Institute of Electrical Engineers such a code would of necessity have to be presented to the standards committee, but the code is in no shape to be presented to the standards committee. Mr. Osgood also said that since the National Electric Light Association is the organization most interested in the code, the code should first have the approval of that association before being considered by the standards committee of the American Institute of Electrical Engineers.

COMMUNICATION FROM ELECTRIC POWER CLUB

After some discussion on station and utilization rules and on "Emergency Car Lighting," C. E. Skinner, representing the Westinghouse Electric & Manufacturing Company and the Electric Power Club, read the following communication:

"Rule No. 315.—We suggest that this rule be deleted. We do not believe that the danger accruing from regular practice is such as to warrant the insertion of a rule in the code. Naturally, good engineering practice requires that proper precautions be taken in running of circuits so as to enclose magnetic material, but we believe that this rule in the hands of over-zealous inspectors could very readily be made to work a hardship."

Objections were also voiced to rule No. 352, rule 326, rule 125-C and rule 300-C. Regarding the latter, the following very pointed questions were asked:

"We desire further information on this paragraph as follows: First, what assurance can be given that there will be some central examining body generally accepted by the various states adopting these rules; second, in the event of the Underwriters' Laboratories making examinations and reports, what assurance can be given that state commissions and others having the administration of the rules will accept apparatus so passed upon; third, is it intended that examined and approved devices should have preference over devices which meet the rules in every way but which have not been subjected to examination; fourth, are there any arrangements under way for providing for qualifying the Underwriters' Laboratories as the examining body and are arrangements being made for qualifying other bodies for doing this work; fifth, is there any definite plan under way for regulating the fees which shall be charged for such examination; sixth, how is it proposed to identify apparatus and devices which have been examined by the properly qualified body; seventh, under whose authority can such a body be properly qualified?"

No very serious objections were made to the adoption of the code by municipalities and state commissions. On the contrary, many heartily indorsed the work of the Bureau of Standards.

DISCUSSION OF TELEPHONE AND TELEGRAPH ENGINEERS

R. L. Rhodes, American Telephone & Telegraph Company, New York, said the bureau has proposed a code which should prove valuable as a reference work for commissions and regulatory bodies formulating local rules, and such use should amply justify the work and expense put upon it. General adoption of the code at present, he said, would be a mistake.

BITTER EXPERIENCE OF ELECTRICAL COMPANIES IN NORTHWEST

J. B. Fisken, Spokane, Wash., representing the Washington Water Power Company and the Northwest Electric Light & Power Association, agreed with the previously expressed sentiments of Messrs. Blood, Osgood and McClelland. Not only will the code not be intelligently administered, he said, but it will not reduce accidents. Electric companies do not guess but know what will be the result of the adoption of the code by a political commission. So far as Washington law is concerned the rules will be retroactive. These conditions do not, however, prevail in Oregon, Idaho and Montana. G. E. Quinan, Seattle, said the wire spacing rules of the code if adopted will necessitate his company rebuilding 5000 poles at a cost of $10 each. This, with other changes, will call for an expenditure of approximately $100,000 on the part of the Puget Sound Traction, Light & Power Company.

OBJECTIONS OF EDISON ASSOCIATION

P. Junkersfeld, Chicago, speaking for the Association of Edison Illuminating Companies, said that while the association cannot indorse the rules, it is willing to continue co-operating with the Bureau as it has in the past. In reply to a direct question from Dr. Rosa asking what if anything can be done to the rules to make them acceptable to the association for trial, Mr. Junkersfeld replied that if the association gives approval political expediency, backed up by legal talent, will use the rules to work mischief. Farley Osgood, Newark, said the attitude of the electric associations is neither to condemn nor indorse the rules. If the Bureau can prevent the rules from becoming law there would be no objection to their issuance and he suggested that the Bureau should include in its budget annually a liberal appropriation for assisting administrative bodies in their interpretation and administration. C. L. Lemaistra, of the English International Electrotechnical Commission, when called upon to give his views, said the English standardization commission had not attempted the superhuman task of drawing up such a code, but had confined its activities to specifications. It has always been extremely careful, said he, that its specifications had not dealt with safety rules. The result had been that most of the specifications represent the best modern practice and to insure keeping each specification up to date a method is provided for effecting a revision each year. In closing he again characterized the preparation of a national safety code a superhuman work and said it was difficult to predict its effect on the industry.

Commission Procedure in Rate Cases

Practise of Illinois Body Traced from Complaint to Written Order

What is perhaps the most important function of the Public Service Commissions in regard to their regulation of electric light and power utilities is that of determination of rates, involving as it does a thorough study of every phase of utility operation and affecting as it does the very life of the utility—namely, its revenue. The procedures of the separate commissions while perhaps different in detail are undoubtedly very much the same fundamentally.

The practice and procedure of the Illinois commission in a utility rate case is somewhat as follows. Complaint is usually made by the city council or village board of some municipality to the effect that rates are high and service is poor. The statute provides that similar complaint may be filed by "any person, corporation, chamber of commerce, board of trade, or any industrial, commercial, mercantile, agricultural, or manufacturing society." At the initial, or preliminary, hearing, the commission endeavors to ascertain how general the complaint may be among the public of a municipality—particularly when complaint is made by other than the duly-constituted city officials. Often it is discovered that the complaint is fundamentally a matter of service and that the consumers would be satisfied with the utility's rates, provided the service itself were not obnoxious. If the case resolves itself into a service complaint, the matter is usually simple of disposition.

Expense of Inquiry Must Be Warranted

Before entering upon a full inquiry into utility rates, the commission takes elaborate pains to satisfy itself that the expense of the inquiry is warranted. It is useless for the municipality and the state to expend public funds raised by taxation on a futile investigation, unless there seems to be reasonable probability of a reduction in rates. Nor is it fair to a utility to engage in a rate case and to require it to expend large sums in the compilation of an extensive inventory, unless the existing rates appear unduly high. As to whether or not an elaborate rate-inquiry is initiated, the commission must decide as judgment dictates.

In the earlier rate cases, when the commission had little data and facts in its files upon which to base rates by comparison, investigations into utility rates were made upon any well-substantiated complaint. As the commission gains in experience, it is requiring the municipalities to make greater showing as to the unreasonableness of the rates complained of—particularly when such rates, by comparison with other rates for similar service in the state, are found to be near an average rate. There is a present tendency on the part of the commission to require some substantial facts and proof on the part of a complaining municipality, and, naturally, an inventory and appraisal by an expert engaged by the city is the best of evidence.

Upon starting a rate investigation, the commission orders a utility to file a complete inventory of its used and useful property, on or before a fixed date. Upon receipt of the inventory, a division of the commission's engineering staff is assigned to the work of making a field check of the utility's inventory. Synchronously with the checking of the inventory, the engineering staff endeavor to ascertain all possible evidence from the books and records of the company relative to the cost and value of the equipment listed. Working in conjunction with the engineering staff, a division of the commission's accounting staff compiles a complete audit of the utility's books of account. It is the endeavor of the commission's employees to obtain every possible fact which experience has shown will bear upon a truthful reflection of values and operating expenses for rate-making purposes.

Following the local field work, the commission's employees at the Springfield headquarters, engage in developing the field notes into tabulations, exhibits, appraisals, audits, etc., to be filed later as evidence in formal hearings of the case. At the present time, three complete valuations are submitted by the staff—one representing the original cost, a second representing the cost of reproduction, and a third representing a normal cost which is a combination of original cost of non-fluctuating equipment, the reproduction cost of land, and a weighted average of fluctuating materials, all modified more or less by the dictates of judicial decisions. The last has been aptly termed "a mongrel."

At the subsequent hearings of the rate case, the engineering and accounting staffs introduce their exhibits as a part of the record and substantiate the same by such description as may seem pertinent. The utility and the municipality are likewise permitted to introduce in evidence such valuations as are desired. All expert witnesses submitting valuations are subject to cross-examination by opposing counsel or by counsel for the commission. Testimony relating to land values is frequently taken by an examiner detailed to hold a hearing in the municipality affected, thereby permitting local real estate men to submit testimony with little trouble and expense.

Whenever the hearings of a rate case are completed, the parties to the cause are permitted to file briefs and to argue orally before the entire commission, if they so desire. The commission assigns to some one of its staff, the duty of abstracting the record of the case. This abstract contains all the tabulations and data which are an essential prerequisite to a judicial determination by the commission of fair and reasonable rates for utility service. The testimony in a utility-rate case is usually voluminous, varying from around 500 typewritten pages to about 7000 pages.

The commission in conference enters an order prescribing the rates and the date upon which the rates are to become effective. The commission's order is subject to review by the Circuit Court of Sangamon County and to appeal to the Supreme Court of Illinois.

Sections of the Associated Manufacturers of Electrical Supplies

A meetings of representatives of the electric lighting fixture manufacturers was held on Thursday, May 25, at the Hotel Biltmore, New York, in response to an invitation issued by the Associated Manufacturers of Electrical Supplies to consider the formation of a lighting fixture section in the association.

Many of the leading fixture manufacturers were represented. The meeting was called to order by the general secretary of the Associated Manufacturers of Electrical Supplies, Charles E. Dustin, who explained briefly that it had been called at the request of a number of fixture manufacturers who are members of the association and who felt that a fixture section would be of great value to the industry.

Thomas M. Debevoise, counsel of the association, gave an outline of the reasons for organizing the Associated Manufacturers, and of the benefits which could be derived through the co-operative efforts of manufacturers along the lines of standardization, etc., and of activities which might well be considered in the section. Mr. Debevoise explained the method used in the forma-

tion of sections, and the divisions by sub-committees of the various lines of manufacture in each section.

The meeting unanimously voted to form a lighting fixture section. H. W. Bliven of Harvey Hubbell, Inc., was elected temporary chairman of the meeting, and Herman Plaut of L. Plaut & Company temporary secretary. The following sub-committees were named: Interior lighting fixtures; industrial lighting fixtures; street lighting fixtures.

Nominations for permanent chairman of the section were made, and this appointment will be made at the next meeting of the board of governors on June 21. Herman Plaut was elected permanent secretary of the section, and H. W. Jones of the General Electric Company permanent treasurer.

The molded or formed insulation section of the Associated Manufacturers of Electrical Supplies will meet at the Hotel Biltmore, New York, on Monday, June 5. E. B. Hatch, chairman of the section, will preside. This is the annual meeting of the section, at which officers will be elected and committees appointed for the coming year. The meeting has been called for 3 p. m.

Directly following this meeting, at 4.30 p. m., the manufacturers of overhead line material will meet to consider a section covering this particular line, which is of greater importance every day, with special problems of its own to be met.

On June 8 the following sections of the Associated Manufacturers of Electrical Supplies will hold their meetings at the Hotel Biltmore, New York: Porcelain section, 9 a. m., J. E. Way, chairman; knife switch section, 10 a. m., J. H. Trumbull, chairman; panelboard and switchboard section, 2 p. m., C. L. Eidlitz, chairman; outlet box section, 3.30 p. m., R. B. Corey, chairman.

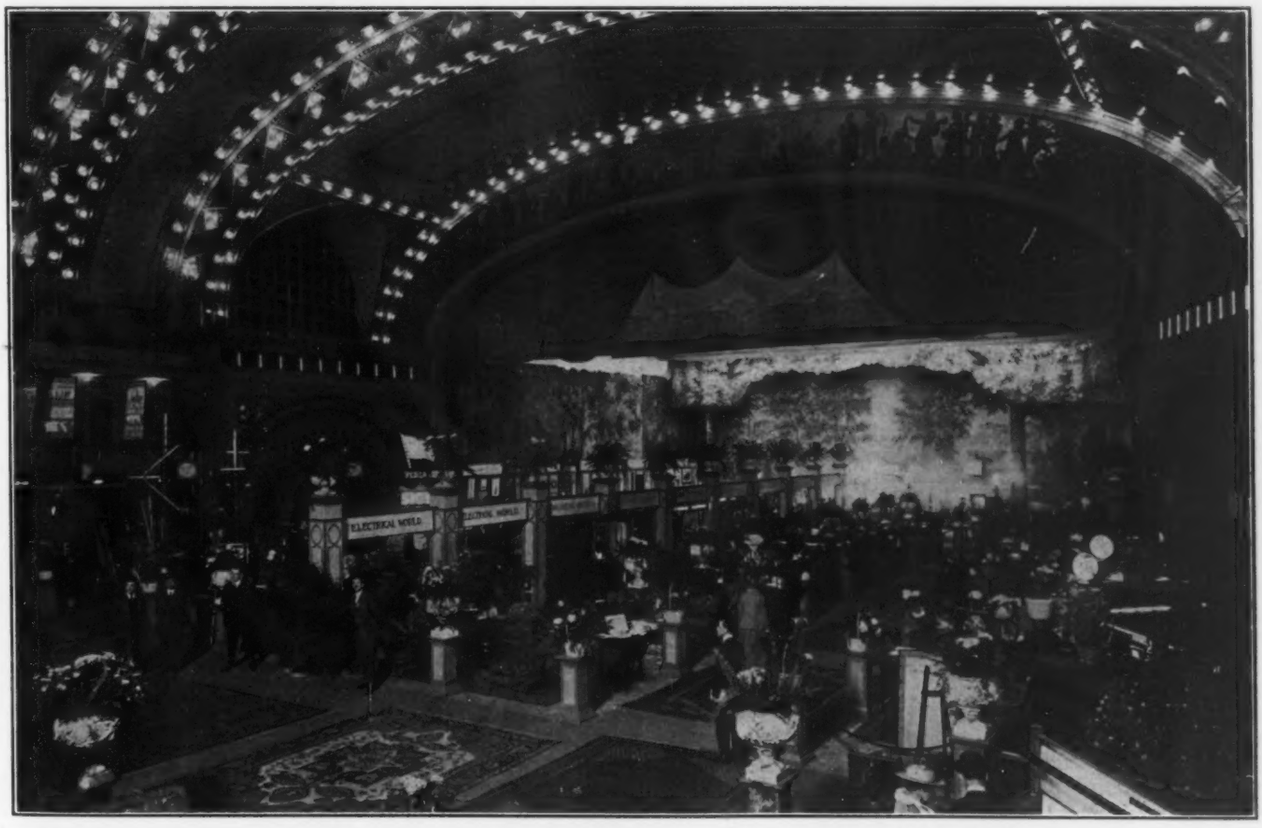
In last week's issue it was erroneously stated that the next meeting of the association would be held at Hot Springs, Va., on June 8. It is the meeting of the fan motor section which will be held at that time and place, not the meeting of the association.

N. E. L. A. Convention Exhibit Successful

Overflowing the space of 15,000 sq. ft. first allotted, being the main floor of the Auditorium Theater, into the ground floor foyer and a large part of the second floor foyer, the exhibit of new devices and apparatus by the Class D manufacturing members of the National Electric Light Association at the annual convention in Chicago a week ago was very successful. In point of interest, utility and attractiveness it is believed that this year's exhibit was the best ever undertaken by the association. A special feature this year was the inclusion of the new Electric Vehicle Section exhibit. There were sixty exhibitors in the exhibition hall and some twenty applications had to be refused owing to lack of space.

Every effort was made to produce an attractive as well as useful exhibit and it was the consensus of opinion of those present that the committee succeeded admirably. The exhibits were so laid out that there was no obstruction to the general view of the exhibit on entering. The decorations and the colors harmonized well with the surroundings. Flowers were abundantly used and concealed banks of vari-colored lamps produced twilight and other effects.

In preparing this exhibit the committee labored under the greatest of difficulties. Besides having to board over the seats of the theater for the floor of the exhibit, put up the booths, and look after the decoration effects, the committee had to contend with the strike of Chicago expressmen which tied up local transportation and caused considerable confusion.



A PORTION OF THE N. E. L. A. CLASS D EXHIBIT, SHOWING THE ARTISTIC ARRANGEMENT OF BOOTHS AND GENERAL DECORATIVE FEATURES

Public Policy Ideals Bring Commercial Results

Hints based on Central Station Experiences Showing the Close Relation Between "Pleasing the Public" and Increasing Sales

These suggestions and criticisms are a collection of practices which have been carefully tested during a long period of years and proved successful. While names of companies and individuals are not published the article is a presentation of facts

CONSISTENCY in policy is too powerful a factor in sound public relations to be disregarded safely. It is equally important as a factor in commercial development. The substantial value of a continuous policy in central station management is proved by the successful commercial growth of more than one company. It is illustrated strikingly in one city where the number of customers equals 15 per cent of the total population. The fact that this particular city and the surrounding villages have increased in population at more than the normal rate has accentuated the effect of the uninterrupted, unchanging policy of the company.

The advantage of a continuing theory in business relations is that consumers know what attitude they will find on matters affecting their service. When the same management is closely in touch with, or directly responsible for, the policy on all questions of principle and detail the public expects a uniform plan of action. One company which maintained its principles consistently has increased its gross earnings in the period of ten years a total of more than 800 per cent.

"Company policy," if wisely formulated, is not a personal matter for one individual or even for two or three officials who meet the public most. It is a living influence in all departments which touch intimately the daily relations of public and utility. To find out what the public wants, to furnish it if it can be furnished, and to say frankly if it cannot be furnished, can be made a fundamental rule to control every branch of the service.

Tested Public Policies

"Company policy is not a personal matter for one individual."

"We have never lost touch with our public and we have never lost touch with our employees."

"The business of the sales department is to make the relation with the public a continuing one."

"To find out what the public wants, to furnish it if it can be furnished, and to say frankly if it cannot be furnished is a fundamental rule."

A Tested Policy

Some twenty years ago the principal owners of a company in a growing community were confronted by a critical situation. The company had been doing only the "cream" of the business, charging high rates and thus developing grave competition. The alternatives open were to try to do all the business at about one-half of the existing rates or to accept the existing undesirable conditions as permanent, with eventual liquidation as a possible contingency. It was decided that better use of the investment had to be made, that financing would have to be on a broader scale, but not necessarily at reduced profit. The statement of principles which was then adopted was in effect as follows:

The property must be maintained so that its value should be not less at the end of the year than it was at the beginning of the year. Full value, not alone operating efficiency, must be maintained.

Two points which were agreed upon as of equal importance and inseparably connected were (1) that the stockholders must have enough return so that they would be contented to hold their investments and supply needed funds for expansion, and (2) in order that a good class of employees should be attracted, that the rates of pay should be a little better than the going average.

The excess in earnings above these requirements, it was decided, should be used to lower rates to the public.

Such a policy is adaptable for utilization to-day. If adopted its spirit can be carried in a practical way into the commercial department, affecting all dealings.

One student of public policy, in conversation with the representative of the Electrical World, urged that service be sold at the least margin above actual cost that will bring new capital into the business. To do this the management would have to know its exact costs and profits. To avoid miscalculation in these vital items is certainly a maxim which no one can afford to ignore. Rate-making that is calculated upon the smallest margin above cost which will bring money into the business has another advantage in that it prevents cut-throat competition. It is a standing notice that any competitor would have to figure very closely to make headway.

In Touch With the Employees

"We have never lost touch with our public," is a statement made by a company president; and he adds, "We have never lost touch with our employees."

In the principles of management the relations with employees are regarded everywhere as of great importance. A conspicuous feature of the management in one leading company is the declaration that the property is only an enlargement of the old-time shop where the "boss" knew all the men and their wives. As a group of employees grows from small to large it is impossible for any one person to keep in close touch with all. But no head of a department is considered a success unless his relations with his staff are pleasant. No one handling gangs of foreign-born laborers is looked upon as successful unless his men go to him with their troubles. The company does not retain anyone who is "high and mighty" with the "help." Though he may have other good qualities his inability to make himself popular with the men employed in his department immediately stamps him as a failure.

The payment of the customary wage, plus a little more, is a rule which has been tested by one head of a department and continued as a matter of business, because it plainly promoted good service. It has strengthened the organization. A company which has never had or believed in a theoretical minimum wage states that its policy is guided by the cost of living and by the fact that it wants to hold good men. "Few actual rules control our welfare work," this company reports. "If we can help our employees we are very thankful for the chance."

The question of publicity is treated from many differ-

ent angles. The policy which governs one company is that its plants, organization and service are a part of the daily life of the community; it wants to be accepted as such; it will make public any facts in response to actual public interest; but it sees no use in the sort of publicity that merely puts its name before the public; if the public does not want to know about internal matters there is no occasion for forcing the facts upon unwilling or uninterested readers; the best publicity is that which arises deliberately from an unswerving policy to serve the public.

A Continuing Relation

"The spirit in which our sales department acts," says a notably successful executive, "is that it is performing a service for the public and its business is to make the relation a continuing one. To further this end the commercial department will find it advantageous to take charge of all claims, complaints and disputes affecting customers in regard to charges, service or the occupation of highways by pole lines or underground mains owned by the company."

Continuity of service is a marvelous factor in the progress of good relations with consumers. In the early days trouble on the power distribution lines caused great difficulty for sales departments, and in order to overcome this, a means of closer co-operation between departments was evolved by various companies. An assistant superintendent of the overhead department and a corresponding official of the underground department are assigned to the sales department of one of the companies which was questioned in regard to its practice. They report to the heads of both their own department and the sales department. Now the emergency men are imbued with the idea of getting the service on. They know what it involves when a factory which has in its employ a force of 5000 men loses its power.

Removing a Cause of Complaint

A small storekeeper telephoned one day to a leading company that the construction department had left material in the street which partly blockaded the way to his shop.

The commercial department, which handles the complaints, got busy immediately.

It did not ask, "Is there any reason why this should be moved?"

Its question was, "Is there any reason why this should NOT be moved?"

Close Contact With Customers

A prominent sales manager urges the importance of keeping in touch with customers. When a contract is signed, the customer should not be forgotten until renewal day draws near. The salesman may make regular calls on a chronic fault-finder to ask if the service is satisfactory. It is not necessary to judge salesmen alone by the new business they get. To keep in close contact with customers and to make full reports as a guide for the management should constitute a large part of their duties.

Every-day experience demonstrates that it is a great advantage for salesmen to put themselves in the consumer's place, asking what his market is and what he has to do in power costs to keep a safe margin in production expense. When these essential points are learned the real study of the case from a power standpoint may be begun. But until the customer's plans are found to be practicable the promotion of business should be a secondary consideration. Some power salesmen have found it profitable to act on the theory that while the sale of service is the entire business of the company the purchase of energy is merely an incidental cost to the customer, and the fair relation of these facts should be kept in mind. If a customer, because of the nature of his demands, cannot be pleased, he is not a permanently desirable acquisition. To follow such a thought means that in many cases prospective consumers will be told frankly all the reasons why they cannot do successfully what they proposed.

A regular practice of meeting customers in this way, followed systematically for years and supported by careful management in the operating departments, will lead people to realize that sound advice will be given, that any service which is really wanted can be secured with reasonable promptness and, as an essential corollary in wise public policy, that the rate will be absolutely fixed. A central station company, like many other industries, can build up the valuable reputation of being a "one-price" institution by consistently refusing business at discriminatory rates.

The commercial manager of a Western company calculates that about two-thirds of the time of the sales department is devoted to old customers. Every salesman keeps a record of his old and new customers. The desire is to have every customer become a good advertisement of the service. Extreme care is taken to avoid any opportunity for friction. Until the first bill for service reaches the customer in this property he is in touch with only one part of the organization—the sales department, which even takes the responsibility for the initial credit.

If a man is a failure in the new-business department of one well-known company the almost invariable reason is his inability or disinclination to find out what the public wants and to report it correctly. In this property the salesmen have a well-understood and accepted individual relation with their own customers. If the customer is not pleased he asks for the man with whom he made his contract; but when any difficulty arises which may cause him to telephone to the general office there is always present some responsible official of the company with whom he can talk if he so desires.

Give Power or Advice

The executive of a company which has built up an enormous industrial load says that his policy is to have salesmen maintain friendly relations with users of power, whether customers or not. "Any concern that needs power in a hurry," he says, "is able to get it from us. Many people expect to produce their own power, find trouble and come to us and we always give them what they need. Our engineers are invariably ready to give advice to people who want it without regard to whether or not they are our customers."

A keen solicitor declares: "We have never been backward about chancing a little loss in order to try a new customer. Losses through rejections of applications by too rigid a credit rule are greater than if we take moderate chances."

A card index record of uncollectable and slow accounts is kept in the commercial department of a rapidly developing central station company. If an applicant has been cut off once or twice for non-payment and asks for service again, he usually gets it. Few security deposits are required, and after a deposit has been held for eighteen months, if the record is good, it is returned. Of course, no chance is taken in cases where a customer's former record shows that he was dishonest or made unnecessary trouble for the credit department.

A trained man has been appointed in one organization to watch all cut-off orders where non-payment is the cause. He hears the customer's point of view and has authority to settle the account. He collects a great many accounts, holds customers and lessens friction. Since this arrangement was begun there have been fewer removals of meters.

The proportion of residences wired for service shows great variation in different cities. The records of one company indicate that it serves 79 per cent of the total number of residences, including the houses built before electricity was known and popular. About 2 per cent of the total, representing old houses, were wired for electricity last year without any contribution on the part of the company. Every new residence in the community which is of a value of $1,500 or more is wired, the executive of one organization writes. The experience of a particularly strong company shows that in its city houses are not being piped for gas lighting and that combination fixtures are not carried by dealers.

TEST THE METERS

A careful observer of central station affairs declares that one of the most important matters which affect public relations is the testing of consumers' meters. Criticism is disarmed if no argument is advanced when a customer asks to have the meter tested. If a customer is dissatisfied and a graphic meter is installed he can see the facts for himself, and he has no suspicion that the company is trying to hide them from him.

Operation of an Ohio Interconnected System

Growth of Ohio Service Company's Properties—Features of Transmission Line Construction—Methods Used in Securing Industrial Loads and Other New Business

THE interconnected transmission system operated in portions of Coshocton, Guernsey, Tuscarawas and Harrison Counties, Ohio, by the Ohio Service Company, a subsidiary of the United Service Company, Scranton, Pa., possesses many features of engineering interest. This Ohio system represents the culmination and extension of several formerly independent systems, some of whose generating plants have been closed down and others have been remodelled or rebuilt to meet present requirements. Furthermore, the consolidation of these systems has permitted extending service to many communities which heretofore were not large enough to support individually generating plants of their own. The communities now served through the installation of suitable outdoor substations range from fifty people up. The communities which are reached at present, as well as those which are within economical connecting distance of the transmission lines, are being canvassed intensively for new business along progressive lines, and a remarkably high percentage of saturation is being obtained in many territories.

REASONS FOR LOCATION OF GENERATING STATIONS

At present nineteen communities (indicated on the accompanying map with their corresponding populations and number of consumers) are being served. The estimated aggregate population of the towns served is 65,450 inhabitants and the total number of consumers is 4685. The generating stations for the system are situated in the largest cities, namely, Coshocton, New Philadelphia and Cambridge. Transmission lines pass through these cities and join a few miles east of New Comerstown, forming a sort of star-shaped system to

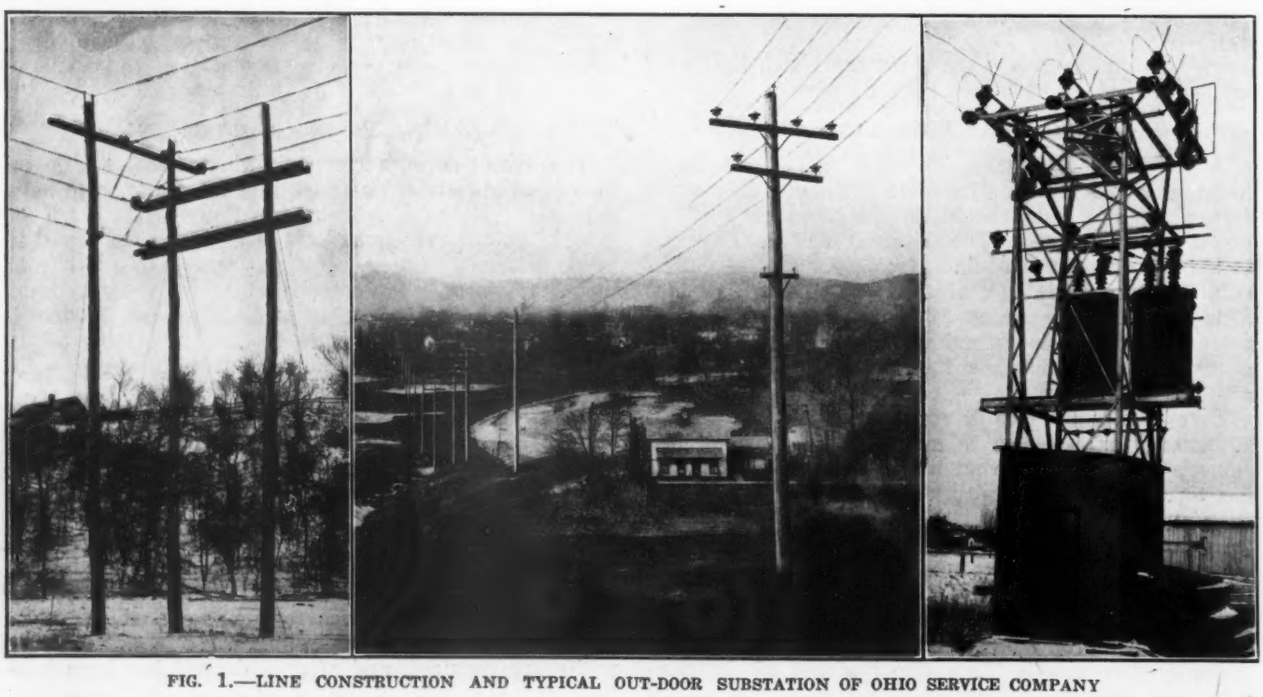


FIG. 1.—LINE CONSTRUCTION AND TYPICAL OUT-DOOR SUBSTATION OF OHIO SERVICE COMPANY

The photograph at the right shows a three-pole turn in a transmission line near Coshocton, Ohio; the center view illustrates a typical straightaway line construction near Dennison, Ohio. These poles carry the 33,000-volt Coshocton-Dennison line and the Dennison-Tippecanoe 13,200-volt line. The substation at the right in the halftone is at West Lafayette, Ohio. Space is provided on the platform for three transformers with only two connected in open delta now installed. Fused air-brake switches and choke coils are provided in the high-tension circuit. The low-voltage switching and metering equipment are in the corrugated metal house. Swivel brackets are attached to the frame work for hoisting and lowering the transformers.

which the other communities are connected. While the operation of generating stations at the approximate extremities of such a system may appear contrary to usual practice in radial systems, it represents the best practice in this case, at least for the present. If a central plant had been built the cost of maintaining a heating plant at New Philadelphia and at Coshocton would have been more than the economies effected by the central station until the load increased to at least twice what it is at present. All apparatus in both stations, however, has been purchased with the idea of moving it to a central plant when such a plant becomes economically possible. It may be pointed out, in this connection, that only the generating plants at Coshocton and New Philadelphia are being operated, the station at Cambridge being of older design and is consequently being held as a reserve for emergency operation. Hot-water heating service is being supplied in Coshocton to a system having about 120,000 sq. ft. of radiation. In New Philadelphia, exhaust steam is being furnished for about 45,000 sq. ft. of radiation. On account of these two heating systems, the plants must be operated for eight months of the year regardless of electrical requirements. Until the electric load grows to such proportions that the economies of the central plant will offset the cost of operating separately the two heating systems, these two plants will be maintained in operation. In anticipation of that condition arising, however, a power-house site has been purchased at New Comerstown on the Tuscarawas River.

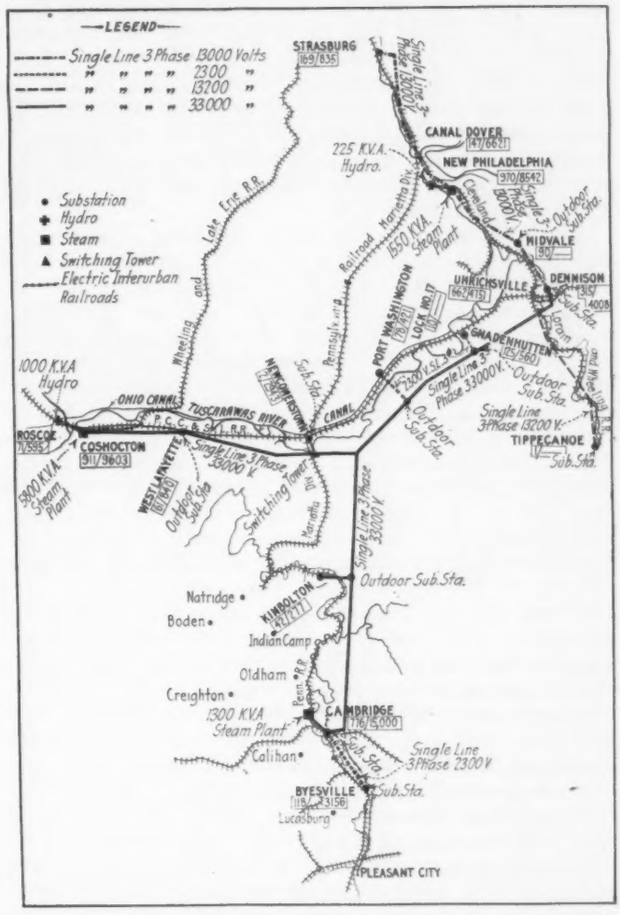


FIG. 2—TRANSMISSION SYSTEM, OHIO SERVICE COMPANY

The fractions inclosed in boxes after the names of towns indicate the saturation of the district. The numerator represents the number of customers and the denominator the population.

GROWTH OF THE SYSTEM

As already mentioned, the present system is the outgrowth of consolidating several independent systems. The interconnection did not take place all at once, however, the history of this consolidation being as follows: The Tuscarawas County Electric Light & Power Company in 1910, which served New Philadelphia and Dennison, was purchased first. Soon thereafter the United Electric Company which furnished Dennison and Uhrichsville with electric service, and operated a street railway between these towns, and also the New Philadelphia Heating Company were taken over. These electric properties were consolidated into the County Electric Company. The railway department was organized as a separate company, called the Twin City Traction Com-

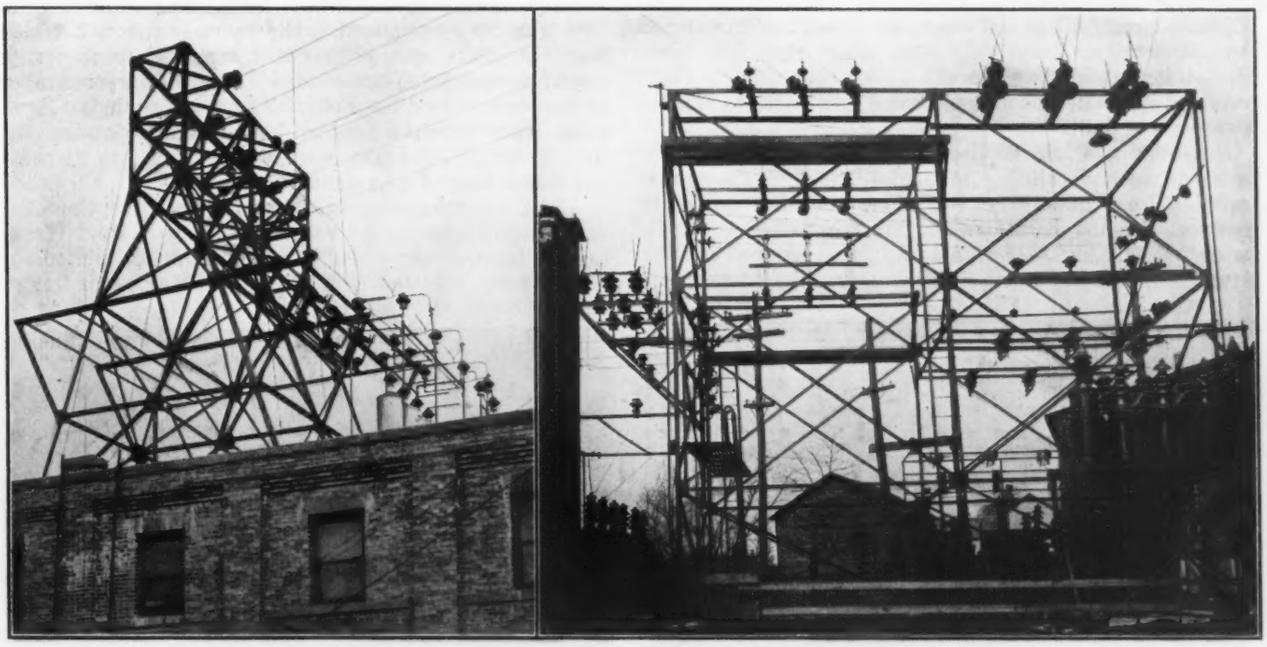


FIG. 3—ROOF TERMINAL CONSTRUCTION, OUT-DOOR TRANSFORMER AND SWITCHING STATION AT DENNISON, OHIO

At the structure shown at the left terminate the 33,000-volt circuit from Coshocton and the 13,200-volt circuit going to Tippecanoe. Jumpers connect the incoming lines with horn gaps, electrolytic lightning arresters and disconnecting switches. At the switching station illustrated at the right in the halftone 33,000-volt energy is stepped down to 13,200 volts and 2300 volts. The higher voltage is for transmission north to New Philadephia and south to Tippecanoe. The lower voltage is for local service.

pany. Later the New Midland Power & Traction Company was acquired and about that time the Lafayette Light & Power Company was organized to secure franchise rights in intervening territory and build the transmission lines. All these companies early in 1915 were consolidated to form the Ohio Service Company. With this company has lately been consolidated the Coshocton Light & Heating Company and other smaller companies acquired.

While taking over and interconnecting several operating systems has the advantage that the markets for energy do not have to be originated as they do when new systems are installed, it has the disadvantage that the existing equipment taken as a whole is seldom of similar design and therefore involves considerable modification to permit synchronous operation. This has been taken care of by rehabilitating the larger stations at Coshocton and New Philadelphia, meanwhile operating them separately. After they were equipped with apparatus that could be operated in conjunction with an interconnected system and supply more than their local loads, transmission lines were erected connecting the three main components of the present system. The small plants in communities served along the route were then shut down and service supplied from the general system. These steps were taken gradually and involved remodeling the steam stations at both New Philadelphia and Coshocton to permit more efficient arrangement of apparatus and allow for extension and replacing some of the older equipment at both places with modern, higher-rated and more economical types. Two hydroelectric plants were inherited with the system, one operating on a 32-ft. head and the other on a 9-ft. head. The former was in relatively good condition. The second, however, was equipped with several small combined belt-connected generators driven by bevel gears. These were shut down and a new direct-drive water wheel installed. In addition the head-race was rebuilt and the dam repaired, thus affording economical utilization of the water-power. The equipment now operated in these stations is indicated in an accompanying table. With these and other changes made, including rehabilitation of distribution systems and erection of out-door substations in various communities, all the towns were interconnected by the system described. The latter step was completed just recently when the lines between New Comerstown and Dennison and from Dennison to Tippecanoe were built.

In order to avoid flooded lands, swamps and natural hazards such as sliding hill sides, most of the transmission lines have been run along the shortest route between feeding points on private right-of-way 100 ft. wide. Where the pole rights had to be secured for the transmission lines these rights cost usually $1 per pole

Form 05

RIGHT OF WAY AGREEMENT.

$ .....

Received from.....

One (1.00) Dollar in consideration of which ..... hereby grant unto.....

.....its successors and assigns, the right to construct, operate and maintain a power line, including the necessary poles, towers, fixtures and wires, with the right to set the necessary guy and brace poles and attach the necessary guy wires over and along the property which ..... own or in which ..... have any interest, in the township of ..... County of ..... and State of Ohio, and also along the roads, streets or highways adjoining the property owned by ..... , said property being bounded on the north by lands of ....., on the south by lands of ..... ; on the east by lands of ..... ; on the west by lands of ....., said sum being received in full payment and satisfaction for such rights and the right to cut any trees necessary to protect said line from possible falling timber.

It is understood and agreed that the said ..... , its successors and assigns, are to pay for all damages to fences, crops or property caused by the erection or maintenance of the lines mentioned above, provided notice in writing is given to said Company, its successors or assigns within thirty days after such damage occurs.

It is further understood and agreed that the said ....., its successors or assigns, are to pay to the undersigned ..... ($) for each and every pole or tower erected in open ground, and ..... ($) for each and every pole or tower erected on fence lines or along roads, streets or highways.

No agent is authorized to make any promise or agreement without the same being incorporated in this agreement nor is any agent authorized to procure a receipt to a voucher except upon payment of the amount, and notice is hereby given that if this agreement is signed without payment being first made, it is done at the signer's risk.

WITNESS ..... hand this ..... day of 191

At .....
(Postoffice Address)

Witness ..... (Land Owner)

Witness ..... (Land Owner)

Witness ..... (Land Owner)

Witness ..... (Land Owner)

State of Ohio,

..... *County, ss.*

Before me, the undersigned, a Notary Public in and for said County and State, personally appeared ..... and ..... Grantors in the foregoing instrument, who acknowledged that they are the owners of the premises therein described, have full power to grant the rights therein given and that they signed said instrument as their free and voluntary act and deed for the uses and purposes therein set forth.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my Notarial Seal, this ..... day of ..... 191 .....

Notary Public

FORM OF RIGHT OF WAY AGREEMENT

site. The form of agreement made with persons assigning pole rights is indicated herewith.

The company operates no transmission lines in Ohio on highways. In following the shortest routes between feeding points, it was frequently necessary to string the lines over hills, but in such cases they were located so that they would be sheltered from high winds. Many poles were purchased from landowners adjoining the line, in which case they were paid 10 cents to 14 cents per lineal foot of pole delivered.

All of the transmission lines with the exception of a few branches, including those extending to Port Washington, Gnadenhutten and Tippecanoe, are insulated for 33,000 volts. However, the line extending from Denni-

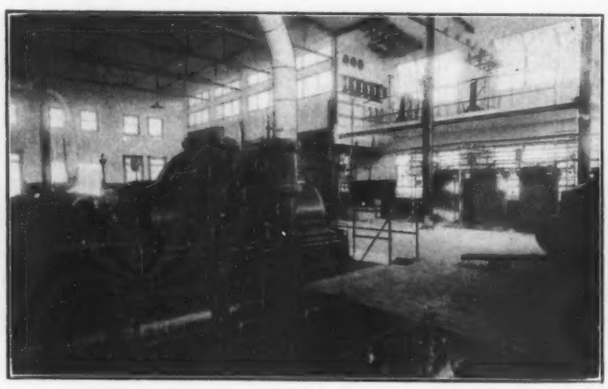


FIG. 4—REMODELED STATION AT NEW PHILADELPHIA WITH ONE 1250-KVA. TURBO-GENERATOR IN OPERATION

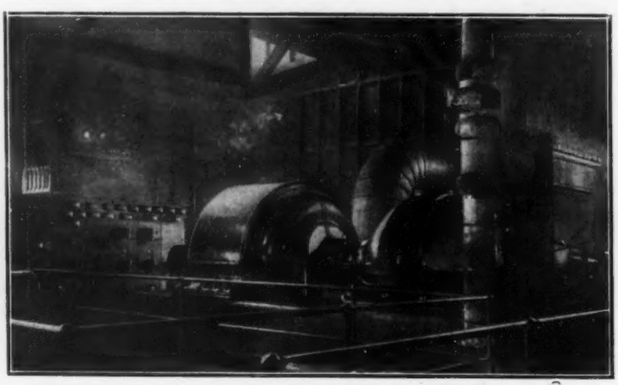


FIG. 5—A 4000-KW. TURBO-GENERATOR IN OPERATION AT THE COSHOCTON STATION BEFORE PLANT WAS COMPLETED

COST OF TYPICAL SUBSTATIONS OF OHIO SYSTEM

COST OF 150-KW., 13,200-VOLT SUBSTATION (See Construction Drawings)	
80 ft. 6 in. pipe (second hand) at 60 cents per foot	$48.00
Channels, angles, bolts, etc.	40.00
Wood plankings and busbar supports	15.00
Foundation concrete, etc	20.00
Labor, erecting, etc	35.00
Structure expense	$185.00
Three 50-kw. transformers	$1,125.00
One electrolytic arrester	325.00
One delta star C. R. E. three-phase unit	210.00
Labor, freight and electrical connections	30.00
Electrical expense	$1,690.00
Total substation cost	$1,848.00
Cost per kilowatt installed	$12.32
COST OF 300-KW., 33,000-VOLT SUBSTATION (See Construction Drawings)	
Structure—8 in. pipe and fixtures	$185.00
Three 100-kw., 33,000-volt transformers	$2,000.00
Electrolytic arrester	600.00
One delta star three-phase C. R. E. unit	310.00
Labor, freight and electrical connections	45.00
Electrical expense	$2,955.00
Total substation cost	$3,140.00
Cost per kw	$10.45

UNIT COSTS PER MILE OF TRANSMISSION CIRCUIT

	Line A	Line B
Securing right-of-way	$41.40	$3.47
Pole rights	103.60	.....
Damages	66.45	3.46
Buying poles	2.22	.....
Inspecting poles	1.70	.....
Cleaning right-of-way	54.50	150.00
Pole cost	201.00	389.00
Hauling poles	7.58	Included in cost
Digging holes	31.80	46.00
Framing poles	8.25	16.50
Creosoting poles	3.08	1.97
Setting poles	25.28	72.70
Cross-arms (total)	78.39	54.13
Pins (total)	25.44	6.10
Insulators (total)	67.44	34.98
Ground-wire supports (total)	17.36	22.55
Telephone supports and insulators	6.12	None
Line hardware	25.60	23.40
Anchors and guys (total)	20.91	37.00
Conductors—three No. 4 copper:		
Material	342.00	261.00
Labor of stringing	45.10	46.40
Ground wire (⅛ Siemens-Martin):		
Material	57.50	39.60
Labor of stringing	14.00	15.00
Ground rods	6.08	4.27
Telephone wire:		
Material	20.60	None
Labor	14.30	None
Camp expenses and meals	83.22	None
Engineering and superintendence	134.22	68.90
General expense	55.60	184.35
Total cost per mile	$1,570.75	$1,480.48

son to Strasburg is not sufficiently loaded for its length at present to warrant employing this voltage, so it is being operated at 13,200 volts. When it becomes desirable to adopt the higher voltage it may be done by merely making changes at the station terminals. Furthermore, the conductors are placed on the cross-arms in such a manner that another line can be installed to furnish 13,200-volt service for intermediate loads. The Port Washington and Gnadenhutten branches operate at 2300 volts. It is probable that these communities and others between them and Coshocton along the northern side of the Tuscarawas River will be connected with a 2300-volt line to serve very small loads that could not be economically served from the existing 33,000-volt system. Several examples of typical line construction, including turns and crossings are shown herewith.

Itemized unit expenses for constructing portions of the 33,000-volt and 13,200-volt transmission lines are tabulated above. The Type A lines, which are three-phase, 60-cycle, 33,000-volt, single-circuit lines, consist of No. 4 medium hard-drawn bare copper wire supported by 45,000-volt Ohio brass insulators on Washington fir cross-arms attached to wooden poles averaging 35 ft. in height. Both wood and steel pins are used. Galvanized 5/16-in. Siemens-Martin stranded ground wire is supported on insulator brackets at the top of the poles and grounded every fifth pole. The data refers to only 20 miles of line running through rural territory in which pole rights had to be purchased and permission secured for cutting trees 50 ft. on each side of the line. Seventy miles of 33,000-volt circuit are installed, however. The maximum pole height is 55 ft., the normal pole spacing 135 ft. and the maximum spacing, 175 ft.

The cost data under the heading Line B are for lines of similar construction except that they are insulated for 13,200 volts. The data refer to 8 miles of line located at Bristol, Pa. Here the line was run on highway, no pole rights being required, but trees along the route needed considerable trimming. The figures for Line B are given to show comparisons in building cost, the lines being practically identical. In the case referred to, pole cutting and conductor stringing was hindered by an adjacent trolley circuit.

DIFFICULTIES OF LINE OPERATION

Forty miles of 13,200-volt transmission lines are included by the Ohio system. The usual amount of trouble has been experienced in operating this transmission system, but most of it resulted on the 33,000-volt lines due to insulator failure. This was attributed to the fact that the 33,000-volt insulator installed in one leg of the line wire showed defects in porcelain. The insulators have been replaced with 45,000-volt units of the

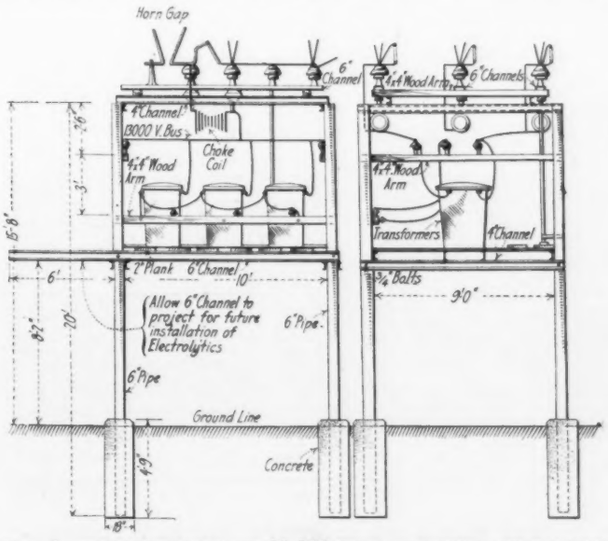


FIG. 6—CONSTRUCTION OF 13,000-VOLT OUT-DOOR SUBSTATION AT STRASBURG, OHIO

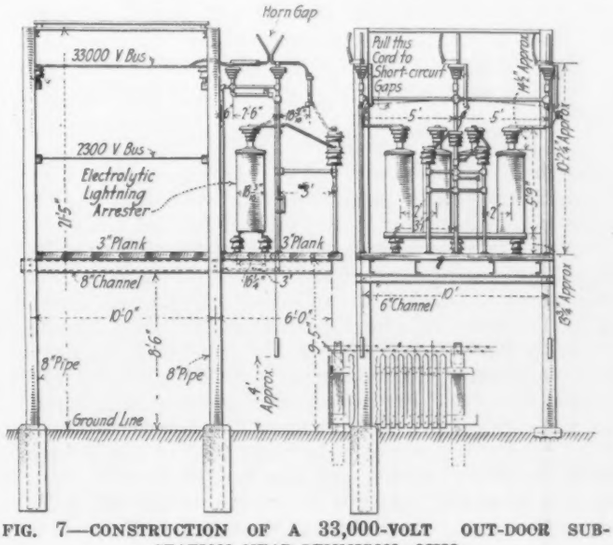


FIG. 7—CONSTRUCTION OF A 33,000-VOLT OUT-DOOR SUBSTATION NEAR DENNISON, OHIO

type mentioned and since then have given complete satisfaction. When the line was first erected some trouble was also experienced by hunter's shooting at insulators and destroying them, about forty insulators being damaged in this manner. The usual difficulties were also experienced due to the operating force not being familiar with transmission lines and their troubles. Since then rigid methods of inspection have been established and troubles from this source are now practically eliminated. Some interruptions to service have been unexplainable, however many have been traced to boys throwing flexible pieces of wire over the conductor to see "fireworks."

FIG. 8—TYPE OF CONSTRUCTION USED AT RAILROAD CROSSING

Except at generating stations at New Philadelphia and Coshocton practically all substation equipment is installed out of doors. At Cambridge and Dennison combined in-door and out-door substations are employed, housings being required for the rotating equipment used to serve electric railways running out of these places. The out-door equipment at these places is relatively elaborate, but the smaller substations serving small communities and industrial plants are comparatively simple in construction and equipment, as indicated by the accompanying drawings and illustrations. A few of the small out-door substations have structural steel supports and frameworks, but the greater number are supported on standards made of old pipe which had been removed from the heating systems in Coshocton and New Philadelphia and could not be used for other purposes. The use of these pipes has permitted constructing substations to suit each particular condition and does not require any shop work. In fact, all work that cannot be performed by the regular line construction gang is done at the nearest blacksmith shop where a hand drill is usually the only available tool. If discarded pipe had not been available it would probably have been more economical to construct the supports and frameworks of angle-iron shapes provided they were made in a shop and delivered to the substation site complete.

INDUSTRIAL LOAD ON SYSTEM

The present industrial load is 6615 hp. with a 3300 kw. maximum peak. Since this load and future growth depend so much on the industrial activities in the territory served a résumé will be given of the principal industries in each community. Cambridge, Byesville, Pleasant City, Kimbolton, and North Salem are noted for their steam-coal mines. Located in Cambridge are also two mills of the American Sheet & Tin Plate Company. Strasburg, Canal Dover, New Philadelphia and Midvale are noted for their fire-clay products, sewer pipe and coal mines. Two mills of the American Sheet & Tin Plate Company and the sheet mill of the Reeves Manufacturing Company are also located in this territory. In addition there are the coke ovens of the M. A. Hanna Company, the Belmont Stamping & Enameling Company, and several smaller industries such as foundries, machine shops, flour mills, etc. Dennison and Uhrichsville are surrounded by sewer-pipe and brick plants. In the former city are also shops of the Pennsylvania Railroad Company. Tuscarawas, Gnadenhutten and Port Washington are small towns, surrounded by clay plants, which seem to be the entire support of these towns. There are a number of domestic coal mines around this territory which are being developed, and rich deposits of fire clay. Coshocton has about the greatest diversity of manufactories. In it are located the American Art Works, Pope-Gosser China Company, Coshocton Glass Company (manufacturing bottles), two glove factories, Clow Manufacturing Company (manufacturing plumber's supplies and cast-iron pipe), a piano and talking machine company, machine shops and foundries. The glass companies in Coshocton and Cambridge represent practically a twenty-four hour load. This also applies to the fans and pumping machinery required by the coal mines and brick and clay mines. New Comerstown contains another branch of the Clow Manufacturing Company.

EQUIPMENT OF TRANSFORMER STATIONS

Stations	No.	Kva.	Voltage		Type*
			High	Low	
West Lafayette	2	25	33,000	2,300	West.
New Comerstown	3	200	33,000 △	2,300 △	West.
Cambridge	3	400	33,000 △	2,300 △	West.
Kimbolton	1	25	33,000 △	2,300 △	West.
Gnadenhutten	3	75	33,000 △	2,300 △	West.
Dennison	3	200	33,000 △	2,300 △	West.
Dennison	3	200	33,000 △	13,200 △	West.
Midvale	3	25	13,200 △	2,300 △	G. E.
New Philadelphia	6	150	13,200 △	2,300 △	G. E.
Coshocton	3	500	33,000 △	2,300 △	West.
Coshocton	3	200	4,000Y	2,300 △	West.
Strasburg	3	50	13,200 △	440 △	West.
Strasburg	3	50	13,200 △	440 △	West.
Strasburg	2	75	13,200 V	440 V	West.
Strasburg	2	25	13,200 V	2,300 V	West.
Tippecanoe	3	100	13,200 △	2,300 △	West.
Schneiders	2	25	13,200 V	440 V	West.

*All oil cooled.

Some of the chief industries served and their kilowatt loads are as follows: Coshocton: Clow Manufacturing Company, 900 kw.; Coshocton Glass Company, 475 kw.; McClurg Rubber Company, 200 kw. Cambridge: The

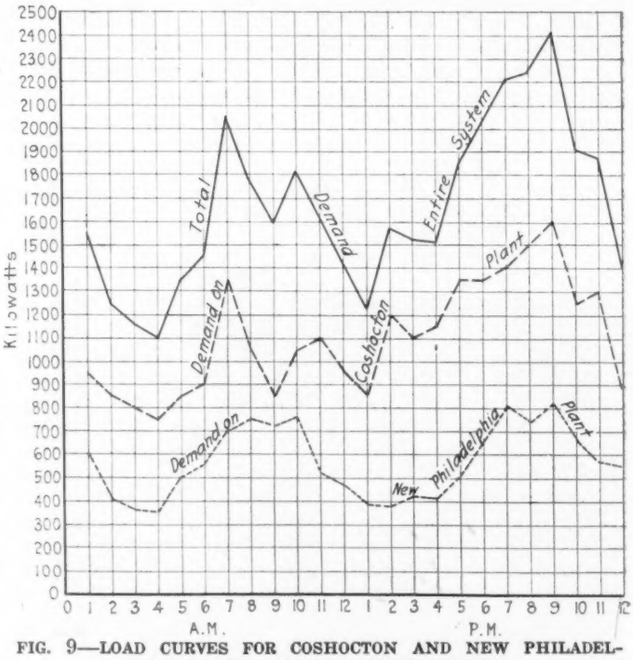


FIG. 9—LOAD CURVES FOR COSHOCTON AND NEW PHILADELPHIA PLANTS AND FOR ENTIRE SYSTEM

Cambridge Glass Company, 200 kw.; Forsythe Coal Company, 400 kw. New Philadelphia and Canal Dover: Harbison-Walker Refractories Company, 300 kw.; Dover Fire Brick Company, 300 kw.; Belmont Stamping & Enameling Company, 150 kw. Dennison: Pennsylvania Railroad Shops, 100 kw.; Evans Clay Company, 100 kw.; Stillwater Coal & Mining Company, 350 kw.

METHODS USED TO SECURE INDUSTRIAL PLANT LOAD

To encourage residence and industrial loads in new fields and present service districts, special campaigns are conducted each fall and spring, special attention being given to the commercial prospects for correct lighting through personal solicitation. Industrial plants are canvassed approximately once a month and reports worked up to compare the cost of steam operation with motor drive and central station power. The same rate schedule applies to every town served by the Ohio Service Company. Up to the present time no customers along the high-tension lines have been connected therewith other than those in small towns where a sufficient number of customers with a possible power load to warrant the extension could be obtained. As soon as greater saturation can be obtained in the towns which are now being served the rural business will be developed extensively. A new community is not considered possible to serve, however, unless twenty-five or more customers with a power load sufficient to pay for the investment in three years can be secured. The earning power of present and future markets for energy is based on a diversity factor of three.

In developing a new community, the highest load factors and best revenue producers are always sought first to offset the burden of the development period. To give diversity and improve the load factor special efforts are devoted to securing the sheet and steel mill loads, brick plant and coal mine loads.

NEW-BUSINESS ORGANIZATION AND METHODS

The Ohio Service Company has a thoroughly organized new-business department, of which each district superintendent is a member. In addition to their other duties the superintendents follow up prospects for the new business. Also the meter readers and all men who come in contact with the public are made to feel that they, too, are members of the new-business department. The manager of new business, who is located in Coshocton, works up all special problems with the district superintendents and solicitors, such as reports on isolated plants, campaigns on house wiring, heating apparatus, etc. To make the small consumers profitable electrical heating apparatus such as sad irons and toaster stoves are sold to them. The practice of the Ohio Service Company is to give each new customer a sad iron or toaster stove at cost price with the privilege of thirty-day trial. Since the meter readers come in contact with the consumers regularly they have opportunities to build up acquaintances and in that capacity suggest to them new uses of electricity. In fact, many valuable sales tips are secured from the meter readers. When customers pay their bills, inquiries are made as to whether the service is satisfactory, each district office in that way being made a clearing house for complaints. In addition, surveys are made twice a year for the same purpose. Complaints are always promptly attended to. The company endeavors to keep in close touch with the newspapers in each community and in most cases secures considerable co-operation therefrom.

To avoid complications in securing franchises to enter new sections, new business is solicited in such a manner that the prospective customer is persuaded to petition for the service first. Thus, the electric service company is enabled to secure distribution rights much more easily than if it presented a petition to supply service, although the final result is the same. After enough petitions for service have been secured to warrant installing a substation and distribution system the petitioners are each requested to sign an application for service, thus assuring some business during the development period.

L. H. Conklin is secretary and treasurer of the United Service Company, Scranton, Pa., and is general manager of all the subsidiary companies; W. C. Sharp is general superintendent of the United States Company. C. H. Howell is manager of the Ohio Service Company; Howard Walker is general superintendent; G. L. Bascome of the United Service Company is electrical engineer; G. A. Mau is manager of new business; J. J. Dolan is superintendent of power stations.

ENERGY CONSUMPTION OF TYPICAL INDUSTRIES SERVED BY OHIO SERVICE COMPANY

Business and Location	Type of Drive	Running Hours per Week	Yearly Output of Product	Kilowatt-Hours Consumed						Connected Horsepower	Number of Motors	Average Kilowatt-Hours per			Maximum Demand (Thirty-Minute Peak) Kilowatts	Load Factor (per Cent)	Details of Equipment
				Jan. / Feb.	March / April	May / June	July / Aug.	Sept. / Oct.	Nov. / Dec.			Motor	Connected Horsepower	Unit of Product			
J. B. Clow & Sons, Coshocton, plumbers' supplies and cast-iron pipe	Mixed	54	.....	60,300 / 72,700	70,300 / 81,300	78,300 / 80,300	84,000 / 79,800	70,200 / 86,500	91,500 / 94,000	615	..	....	1530	..	500	30	Two 290-hp motor-generators; 35 hp in a.c. motors.
Coshocton Glass Co., Coshocton, manufacturer of liquor bottles	Mixed	144	3,500,000 bottles (rated)	11,110 / 8,000	10,400 / 25,900	46,800 / 11,200	11,200 / 13,400	36,600 / 65,700	72,500 / 81,400	365	9	43,800	1080	112.5 /M	143	85	Two 75-hp compressors; two 50-hp Sirocco blowers; one 50-hp compressor (all 900 r.p.m. three-phase 60-cycle G. E. motors); also 35 hp in box and blacksmith shops.
Dover Fire Brick Co., Strasburg	Individual	54	10,800,000 brick (actual)	11,190 / 11,550	10,600 / 22,250	32,960 / 19,850	19,050 / 21,740	20,070 / 23,940	25,460 / 28,660	225	9	27,400	1100	23/M brick	75	37	Two 40-hp 580 r.p.m. slip-ring motors, on dry and wet pans (9 ft.). One 40-hp-screen-clay machine, one 10-hp-dry press, one 30-hp-pugmill, one 40-hp-wet press, one 7.5-hp-fan, one 15-hp-fan, one 3-hp-pump, all induction motors.
Stillwater Coal Co., Stillwater, shaft coal mining (steam and domestic coal)	Individual	96	5,212,500 tons (actual)	27,150 / 24,300	19,400 / 26,300	..... /	..... /	..... / 25,100	28,000 / 31,550	600	4	45,500*	303*	3.5/ ton	96	35	One 150-kva 440-volt, one 200-kva 440-volt Lynch motor generator; one 75-hp hoist, one 25-hp 2-speed fan, induction motors.
Dennison Water Works, Dennison, city water pumping to reservoir	Individual	147	649,568,000 million gallons	90,598 / 112,908	96,418 / 118,146	98,164 / 102,044	100,686 / 107,864	109,416 / 104,566	108,834 / 109,619	200	2	630,000	6300	1945/ mill. gal.	160	90	One 25-hp centrifugal pump; one 175-hp centrifugal pump.

*For seven months' operation only.

Increase of $5,200,000 in March Energy Revenue

Gross Earnings from Light and Power Sales for First Quarter of 1916 Total $107,300,000—Output Equals 5,452,000,000 Kw.-Hr.

BOTH earnings and output of the central station industry of the United States for March last, according to the statistics received and compiled by the ELECTRICAL WORLD, were in excess of those of March, 1914, by a very gratifying amount. The gross income from light and power sales for March, 1916, was $34,000,000, in comparison with $28,800,000 for March of the previous year, which is a gain of 18 per cent, or $5,200,000. The output for March, 1916, was 1,867,000,000 kw.-hr., in comparison with 1,485,000,000 kw.-hr. for March, 1915, an increase of 382,000,000 kw.-hr., or 25.8 per cent.

The March, 1916, output was larger than that for any previous month, but since the lighting hours in March were decidedly less than those for either February or January, the March income was the smallest of any of the first three months of the year. Since the output for March, 1916, was greater than for any previous months, it would indicate an expanding demand on the part of industrial establishments for electric power.

For the first quarter of the present year, the industry's gross earnings amounted to $107,300,000, which was 15.6 per cent or $14,300,000 greater than that for the first quarter of 1915. The output for the first quarter of the present year amounted to 5,452,000,000 kw.-hr., which was 25.8 per cent or 1,113,000,000 kw.-hr. greater than that for the first quarter of last year.

It will be noticed from a study of Tables I and II that the percentage of increase for gross income was greater during the month of March last than during the month of February, while in every case the percentage increase in output was less for March than for February. This is easily understood when it is remembered that February, 1916, had one more day than February, 1915, and since the phenomenal growth this year is attributable mostly to power load which does not command as high a rate per kilowatt-hour by far

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1915	1914	Per Cent Increase	1915	1914	Per Cent Increase
April	65	$18,406,412	$17,675,784	4.2	900,536,022	859,235,144	4.8
May	65	17,644,205	16,764,546	5.3	920,895,324	842,386,583	9.3
June	65	17,603,614	16,476,255	6.9	925,067,308	836,292,076	10.6
July	64	18,488,793	17,200,827	7.5	971,699,054	880,768,487	10.4
August	64	17,342,796	16,024,893	8.2	951,752,053	853,381,696	11.3
Sept.	65	18,547,170	17,074,927	8.6	1,003,606,094	871,573,412	15.1
Oct.	65	20,112,813	18,329,490	9.8	1,087,786,658	949,288,459	14.7
Nov.	65	21,899,048	19,720,232	11.6	1,150,669,073	948,704,941	21.3
Dec.	64	23,418,774	20,962,264	11.8	1,230,655,404	1,004,108,399	22.5
		1916	1915		1916	1915	
Jan.	65	25,286,336	22,352,721	13.2	1,200,672,452	984,205,683	22.0
Feb.	64	22,025,508	19,061,417	15.7	1,111,999,218	857,915,989	29.7
March	64	21,764,199	18,469,047	18.0	1,194,340,132	950,153,185	25.8

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.
INCOME:										
Group 1	6.5	5.3	7.2	7.3	8.7	9.8	10.2	10.7	14.0	16.4
Group 2	2.8	8.8	9.1	10.0	11.4	12.8	13.8	21.3	20.0	18.7
Group 3	10.1	9.7	14.5	15.4	23.4	18.0	19.8	18.3	20.7	28.1
Group 4	6.9	8.2	8.0	9.0	8.7	11.9	13.6	13.1	15.7	17.5
Group 5	4.7	8.5	7.5	11.9	5.7	13.0	13.0	7.2	18.5	26.3
OUTPUT:										
Group 1	10.1	11.1	9.7	12.2	10.7	17.0	19.0	19.0	26.2	22.7
Group 2	9.1	18.1	19.0	18.9	21.4	29.0	31.5	28.0	40.6	28.3
Group 3	11.2	4.5	13.0	24.0	27.3	36.0	33.0	33.2	39.6	39.0
Group 4	6.0	12.5	10.9	11.3	13.4	18.0	16.3	22.6	29.7	18.6
Group 5	14.8	20.5	12.7	19.3	1.7	13.4	9.7	8.5	22.4	30.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1915	1914	Per Cent Increase		1915	1914	Per Cent Increase		1915	1914	Per Cent Increase		1915	1914	Per Cent Increase
INCOME	April	67	$2,109,767	$1,976,473	6.8	69	$7,510,810	$7,241,164	3.9	57	$5,003,673	$4,773,949	4.8	88	$3,475,740	$3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,946,907	4,577,818	8.1	88	3,383,749	3,233,989	4.8
	June	67	2,063,423	1,874,575	10.2	69	6,945,986	6,628,523	4.8	57	4,993,410	4,492,411	11.2	88	3,409,738	3,281,696	3.9
	July	66	2,020,513	1,835,968	10.2	68	6,710,217	6,519,442	2.9	56	4,801,699	4,211,641	13.9	88	3,539,168	3,317,713	6.8
	August	63	2,057,035	1,855,140	11.0	68	6,853,118	6,511,307	5.3	56	4,749,082	4,231,322	12.2	88	3,545,454	3,288,729	7.8
	September	66	2,162,064	1,949,663	11.0	68	7,288,842	6,904,245	5.5	57	5,285,358	4,691,751	12.6	88	3,664,215	3,387,717	8.2
	October	66	2,327,214	2,073,059	12.3	68	8,096,982	7,550,808	7.2	57	5,820,653	5,153,314	13.0	88	3,798,012	3,477,051	9.3
	November	66	2,472,539	2,188,049	13.0	67	8,894,805	8,158,589	9.0	57	6,342,582	5,554,226	14.2	88	4,069,995	3,703,124	10.0
	December	66	2,817,557	2,448,813	15.0	67	9,335,396	8,529,866	9.4	57	6,983,909	6,063,349	15.1	88	4,150,045	3,773,810	10.0
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	66	2,819,144	2,432,177	15.0	67	9,589,347	8,564,488	12.0	57	7,834,831	6,717,799	16.6	88	4,182,114	3,823,156	9.4
	February	66	2,599,760	2,185,967	18.8	67	8,978,797	7,854,345	14.3	57	6,660,062	5,568,337	19.7	86	3,663,268	3,338,489	9.8
	March	66	2,595,777	2,122,177	22.0	67	8,993,984	7,655,990	17.5	56	6,367,764	5,298,455	20.1	86	3,682,743	3,274,175	12.5
KW.-HR. OUTPUT	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,967,434	237,673,326	8.5	88	246,287,781	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	262,885,043	236,154,464	11.2	88	254,586,394	236,082,868	7.8
	June	67	71,566,127	60,972,379	17.4	69	318,245,370	293,751,083	8.5	57	265,930,311	234,286,440	13.2	88	261,083,835	237,843,021	9.8
	July	66	71,025,184	60,755,381	17.0	68	320,371,761	293,909,832	9.0	56	264,498,989	232,541,585	13.9	88	274,488,334	258,475,004	6.3
	August	63	71,954,506	60,870,433	18.5	68	329,947,721	302,960,234	8.9	56	272,508,518	240,423,753	13.4	88	276,631,551	248,463,980	11.3
	September	66	74,635,203	63,716,224	17.3	68	358,765,971	319,549,780	12.3	57	286,893,057	247,046,941	16.1	88	279,133,989	237,795,633	17.5
	October	66	82,568,951	69,882,867	18.3	68	400,516,741	353,685,472	13.3	57	305,962,017	268,972,416	13.7	88	292,885,623	251,095,356	16.8
	November	66	87,193,883	69,359,620	25.8	67	420,584,253	355,151,259	18.5	57	333,528,905	269,870,536	23.7	88	301,772,412	248,913,893	21.0
	December	66	99,744,195	80,446,521	24.1	67	447,158,465	373,213,316	20.0	57	363,859,444	293,266,707	24.1	88	311,034,100	249,996,678	24.5
			1916	1915			1916	1915			1916	1915			1916	1915	
	January	66	97,072,794	77,029,974	26.2	67	431,201,554	356,809,437	20.8	57	362,121,067	284,407,361	27.5	88	301,645,060	258,982,414	16.5
	February	66	92,855,679	68,982,535	34.8	67	411,715,612	320,924,478	28.1	57	339,326,360	252,816,291	34.1	86	259,680,376	209,414,926	24.0
	March	66	97,321,924	74,958,898	29.9	67	439,587,380	349,280,098	26.0	56	353,753,570	275,825,995	28.3	86	294,758,332	243,347,723	21.3

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.
INCOME:										
Group 1.....	11.6	11.2	11.0	10.6	12.7	13.8	14.8	16.5	18.0	21.5
Group 2.....	7.0	7.0	9.6	10.3	12.6	12.7	16.1	15.4	19.9	19.0
Group 3.....	21.8	10.2	16.5	14.7	17.3	15.5	22.8	22.1	29.7	38.7
Group 4.....	11.9	6.6	9.2	10.0	8.8	9.0	9.6	11.3	15.1	18.1
Group 5.....	2.8	16.0	21.2	5.8	8.3	13.7	23.5	20.6	26.3	54.5
OUTPUT:										
Group 1.....	19.0	17.2	17.2	19.2	20.8	28.7	26.2	29.0	38.5	30.9
Group 2.....	20.8	26.0	26.0	21.7	18.3	30.0	26.5	26.0	36.8	27.8
Group 3.....	17.9	13.5	12.3	14.4	8.7	23.0	22.5	39.5	41.6	49.0
Group 4.....	17.1	7.8	13.6	9.0	20.6	20.1	18.5	15.0	23.0	17.4
Group 5.....	1.0	11.0	15.1	8.5	1.8	51.0	14.5	22.6	25.6	58.7

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.
INCOME:										
Group 1.....	3.8	1.4	4.0	4.4	6.2	7.6	8.3	11.1	13.7	16.7
Group 2.....	8.0	9.7	11.6	11.0	11.9	15.0	14.0	18.2	18.4	23.0
Group 3.....	7.5	7.5	8.5	8.9	11.0	10.0	13.1	11.9	14.6	20.5
Group 4.....	3.9	7.0	8.4	10.0	9.8	14.4	15.3	17.4	19.4	18.0
Group 5.....	14.8	†	2.0*	14.3	10.9	14.6	12.2	16.0	15.8	12.2
OUTPUT:										
Group 1.....	8.2	8.0	9.0	11.6	12.1	16.0	20.1	21.1	30.8	29.2
Group 2.....	11.0	17.0	15.0	16.3	16.8	26.6	25.5	26.4	33.4	26.7
Group 3.....	7.2	7.5	6.4	10.4	15.8	22.1	16.6	20.1	22.0	16.0
Group 4.....	7.1	13.8	13.2	12.5	14.8	22.0	18.9	15.6	21.8	20.8
Group 5.....	61.8	†	11.4	13.8	2.8*	18.6	20.6	1.5	24.0	13.1

*Decrease. †Results omitted owing to insufficient returns.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.
INCOME:										
Group 1.....	11.4	11.8	12.2	12.4	12.3	17.0	15.8	14.3	18.3	19.5
Group 2.....	5.6	7.0	7.5	8.6	10.2	10.8	9.8	25.5	20.5	19.1
Group 3.....	19.6	16.4	21.0	22.0	22.7	24.0	25.1	24.3	27.0	23.0
Group 4.....	12.4	13.0	16.9	17.9	16.0	19.8	18.3	9.6	21.1	23.7
Group 5.....	5.0	1.2	20.2	13.5	24.7	9.6	18.0	5.7	11.1	14.5
OUTPUT:										
Group 1.....	10.8	11.8	12.2	15.2	10.4	22.0	21.9	24.9	30.3	25.5
Group 2.....	13.5	11.1	9.8	9.0	14.0	21.5	31.0	28.8	44.0	32.3
Group 3.....	26.1	28.9	31.0	29.3	34.2	43.0	41.2	32.5	44.0	40.6
Group 4.....	15.7	18.2	26.1	29.0	33.5	36.7	18.5	53.4	41.4	33.7
Group 5.....	20.4	24.9	25.1	48.0	3.0	17.3	20.6	13.3	15.9	18.9

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb	Mch.
INCOME:										
Group 1.....	9.0	5.1	7.0	13.9	7.5	7.5	6.0	11.6	6.7	8.5
Group 2.....	11.1	13.0	11.1	11.5	14.3	15.7	17.3	†	†	18.7
Group 3.....	3.6	7.9	17.1	19.7	21.4	20.0	24.6	19.7	22.0	28.1
Group 4.....	1.6*	7.8	0.2	0.3	0.1	4.3	10.8	3.0	8.2	17.5
Group 5.....	3.3	4.5	1.7*	15.0	3.1	13.5	3.9	10.5	17.8	26.3
OUTPUT:										
Group 1.....	10.8	6.2	6.3	8.4	7.1	9.9	13.1	9.1	13.0	22.7
Group 2.....	14.9	27.5	39.3	40.3	41.3	51.0	56.0	†	†	28.3
Group 3.....	12.4	8.4*	18.5	49.2	52.4	67.0	67.0	56.0	68.8	39.0
Group 4.....	4.5*	11.8	0.2	4.1	1.5	6.2	10.5	1.8	13.8	18.6
Group 5.....	3.6	10.9	8.0	21.0	3.5	8.3	1.0	1.0	20.1	30.0

*Decrease. †Results omitted owing to insufficient returns.

as the lighting load, the extreme differences would naturally manifest themselves on the side of output.

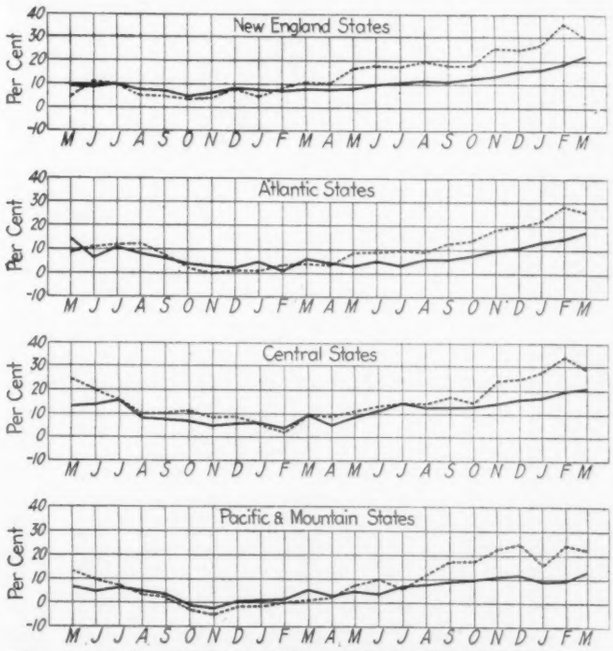
Industrial conditions throughout the month continued on a very broad scale. Production was abnormally high, but at that was not able to keep up with consumption. In almost every line mills have been working at top speed and on overtime. A twofold indication of the extent to which industrial concerns were being pushed in the matter of production were the very high prices paid for labor, because of its scarcity and the inability to meet a normal schedule of deliveries, owing to the scarcity of raw materials. Mines and metal industries, although turning out a greatly increased volume of their products, could not meet the demands.

The extent to which the central station industry profited by this abnormal industrial prosperity is evident in the report from manufacturers and jobbers of electrical goods. All departments of the electrical manufacturing industry from which the ELECTRICAL WORLD has received information, state that their business was breaking all records and that their difficulty was in keeping up with the volume of orders. Motor manufacturers have been swamped with business, and all of the motors ordered are for immediate use.

Isolated plants have probably been giving way to central station service more rapidly since last summer than in any previous period. The sudden demands made on manufacturers for their products forbade the installation of additional isolated plant equipment, and the quality and quantity of orders demanded a service that was absolutely certain.

Besides industrial establishments the mines are using far more energy this year than last for two reasons: First, output is running to capacity limits, and, second, more mines are taking central station service. One other outstanding feature, the results of which are very noticeable in the figures for the Far West, is the recent electrification of the mountain division of the Chicago, Milwaukee & St. Paul Railway.

The accompanying curves show graphically by geographical sections the percentage of increases in income and output over a period of months as contained in Tables I and II. The remaining tables show the percentages of increase in income and output by sections in which the companies are grouped according to the size of the communities served. Group 1 includes those companies operating in cities of over 100,000 population; group 2 in cities between 50,000 and 100,000 inhabitants; group 3 between 25,000 and 50,000; group 4 between 10,000 and 25,000, and group 5 between 5000 and 10,000.



FIGS. 1 AND 4—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT—SECTIONALLY

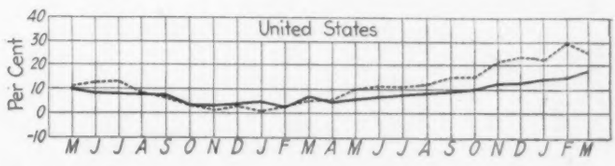


FIG. 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT—UNITED STATES

Iowa Central Station Facts and Factors

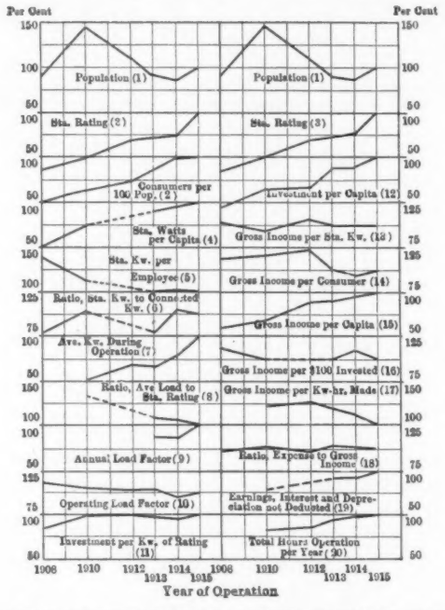
Number of Smaller Stations Decreasing—Output of the State Increasing While Rates and Expenses Grow Less

THE report of the facts and factors committee of the Iowa Section National Electric Light Association, made before the recent Dubuque convention for the year 1915, records more municipal data than have appeared in previous reports, yet the number of commercial stations to respond is somewhat less than last year. The reason is probably found largely in the many changes which have occurred in ownership, management and equipment of these Iowa stations during the past year and the resulting readjustment of operating methods and conditions. The coming year promises even greater changes. The decrease, however, is mostly in the case of the smaller stations, and while the number of commercial reports decreased about 23.5 per cent, yet the decrease in population represented is only about 12 per cent. The total population represented by both commercial and municipal figures is nearly 500,000, about 488,000 last year and 452,000 this year. Of the population represented by the present report, about 89 per cent is served by commercial stations.

TABLE I—NUMBER OF INDIVIDUAL REPORTS INCLUDED IN EACH GROUP FOR EACH YEAR OF GENERAL REPORT

Year of Operation	1908	1910	1912	1913	1914	1915
Group I	10	13	14	18	21	18
Group II	8	4	6	7	10	3
Group III	3	6	8	11	8	6
Group IV	2	5	3	4	6	6
Group V	3	3	7	6	6	6
Total commercial	26	31	38	46	51	39
Municipal	..	..	..	10	13	17
Total commercial and municipal	26	31	38	56	64	56

The accompanying curves show at a glance the trend, by percentages, of the twenty factors from 1908 to 1915, covering a period of seven years. In studying these curves, each one of which represents one factor, it must be taken into account that all factors depend largely upon the population, factor No. 1, and upon the station rating, factor No. 3. Consequently in reports for those years when the average population and station rating are high, certain factors will not have the same trend that would otherwise be the case if the average popula-


Per Cent
Per Cent
Population (1)
Sta. Rating (2)
Sta. Rating (3)
Consumers per 100 Pop. (2)
Investment per Capita (12)
Sta. Watts per Capita (4)
Gross Income per Sta. Kw. (13)
Sta. Kw. per Employee (5)
Gross Income per Consumer (14)
Ratio, Sta. Kw. to Connected Kw. (6)
Gross Income per Capita (15)
Ave. Kw. During Operation (7)
Gross Income per $100 Invested (16)
Ratio, Ave Load to Sta. Rating (8)
Gross Income per Kw-hr. Made (17)
Annual Load Factor (9)
Ratio, Expense to Gross Income (18)
Operating Load Factor (10)
Earnings, Interest and Depreciation not Deducted (19)
Investment per Kw. of Rating (11)
Total Hours Operation per Year (20)
1908 1910 1912 1913 1914 1915
Year of Operation

TREND OF THE TWENTY FACTORS LISTED IN TABLE III OPPOSITE, DURING LAST SEVEN YEARS

TABLE II—CENTRAL STATION STATISTICS FOR THE STATE OF IOWA

MUNICIPAL STATIONS

Station Number	Population of District	Number of Consumers per 100 Population	Station Rating, Kw.	Station Rating per Capita, Watts	Station Rating per Employee, Kw.	Station Rating to Connected Load, per Cent	Average Load During Operation, Kw.	Ratio, Station Rating to Average Load, per Cent	Annual Load Factor, per Cent	Operating Load Factor, per Cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw.-hr. Made, Cents	Ratio of Expense to Gross Income, per Cent	Earnings from Operation per $100 Invested, Interest and Depreciation Not Deducted	Total Hours of Operation per Year
Factor No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
40	800	20.6	120	150	120	....	....	....	....	....	108	16.25	28.50	20.70	4.27	26.30	....	64.4	9.34	8,760
41	1,100	17.7	75	68	25	45	10.5	14.0	....	....	293	20.00	72.20	27.70	4.92	24.60	6.3	61.1	9.55	8,240
42	1,100	17.7	95	86	32	95	8.3	8.8	18.5	18.5	195	16.82	60.10	29.30	5.19	30.90	7.8	63.5	11.24	8,760
43	1,800	16.1	210	117	52	....	27.4	13.0	30.2	30.4	147	17.10	48.30	34.90	5.63	32.90	4.2	82.5	5.77	8,700
44	1,854	17.5	195	105	39	97	....	....	....	....	179	18.90	57.60	34.60	6.05	32.10	....	94.2	1.82	8,240
45	2,150	23.9	135	63	23	....	29.0	21.5	23.2	23.2	341	21.40	133.70	35.20	8.40	39.20	7.1	72.0	10.96	8,760
46	2,400	24.4	100	42	25	....	25.9	25.9	27.1	28.8	240	10.00	166.60	28.50	6.95	69.50	7.8	60.0	27.70	8,250
47	2,400	19.9	150	62	50	62	25.7	17.1	17.2	34.2	113	7.08	61.40	19.30	3.84	54.20	8.2	....	.....	4,400
48	2,500	13.8	200	80	50	54	12.7	6.4	10.6	10.6	110	8.80	41.80	24.20	3.35	38.00	7.5	87.6	4.71	8,760
49	3,000	20.0	150	50	37	....	40.0	26.7	....	....	300	15.00	146.70	36.70	7.33	48.90	6.3	70.5	14.44	8,700
50	3,581	21.5	225	63	59	56	35.3	15.7	19.6	19.6	267	16.75	142.60	41.70	8.96	53.50	10.4	71.7	15.17	8,760
51	4,025	21.7	350	87	50	70	48.7	13.9	26.2	27.0	143	12.40	56.60	22.60	4.92	39.60	4.8	65.2	13.80	8,500
52	4,052	16.3	175	43	29	....	47.6	27.2	....	....	403	17.38	142.70	37.80	6.16	35.50	6.0	55.8	15.65	8,760
53	4,300	17.2	375	87	62	....	61.4	16.4	....	....	187	16.30	73.80	37.30	6.43	39.50	5.1	63.6	14.39	8,759
54	4,500	18.7	275	61	91	111	57.0	20.7	26.0	26.0	182	11.10	109.00	35.70	6.67	60.00	6.0	33.3	40.00	8,760
55	5,500	25.5	500	91	33	....	125.0	25.0	25.0	25.0	300	27.30	130.00	46.40	11.81	43.30	5.9	....	.....	8,760
56	6,300	21.4	500	79	62	100	100.2	20.0	36.5	36.5	175	13.90	88.20	32.70	7.00	50.40	5.0	44.9	27.75	8,760
Average—1915	3,021	19.6	225	78	40	77	43.6	18.2	23.6	25.4	217	15.68	91.75	32.66	6.35	42.26	6.6	66.0	14.82	8,392
1914	2,513	18.3	216	83	48	102	32.4	15.8	22.2	27.1	180	13.44	69.10	30.05	5.40	41.50	7.9	69.3	12.68	7,629
1913	2,640	16.0	177	65	36	86	33.7	21.4	21.8	29.6	219	12.37	97.11	31.45	5.13	43.54	8.5	71.1	12.16	6,590

tion and station rating had been the same for all years. The curve representing gross income per consumer, No. 14, illustrates this point. The chart shows that the grand average gross income per consumer was less in 1914 than in 1913 and 1915. At the top of the chart it will be noticed that the average population was also less in 1914 than in 1913 and 1915.

It should be noted in connection with Table III that the additional factors are derived from group averages and have different values than they would have if they had been the averages of factors computed from each individual station. They continue consistent in showing that energy manufactured per capita and per consumer increases and that expenses and gross income per unit of this energy decrease as the population of the district served becomes larger. Comparing the operations of 1915 with those of 1914, a healthy growth is seen in the kilowatt-hour output and it is apparent that both expenses and rates per kilowatt-hour have been lowered.

In presenting the twenty factors in the tables for commercial and municipal stations, the committee makes the following statement, which will serve to more

TABLE III—CENTRAL STATION STATISTICS FOR THE STATE OF IOWA

COMMERCIAL STATIONS

Station Number	Population of District	Number of Consumers per 100 Population	Station Rating, Kw.	Station Rating per Capita, Watts	Station Rating per Employee, Kw.	Station Rating to Connected Load, per Cent	Average Load During Operation, Kw.	Ratio, Station Rating to Average Load, per Cent	Annual Load Factor, per Cent	Operating Load Factor, per Cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw.-hr. Made, Cents	Ratio of Expense to Gross Income, per Cent	Earnings from Operation per $100 Invested, Interest and Depreciation Not Deducted	Total Hours of Operation per Year
Factor No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
GROUP I																				
1	340	13.2	20	59	10	111	1.7	8.2	12.8	18.0	$250	$14.71	$78.00	$34.70	$4.58	$31.20	15.1	92.9	$2.20	6,250
2	530	23.6	25	47	12	25	4.0	16.0	20.0	20.0	240	11.32	120.00	24.00	5.66	50.00	8.6	80.0	10.00	8,760
3	600	25.0	35	58	17	....	....	....	....	....	343	20.00	77.10	18.00	4.50	22.50	....	77.8	5.00	560
4	600	26.7	75	125	37	94	5.9	7.8	13.3	13.3	93	11.67	60.00	28.10	7.50	64.30	8.8	55.6	28.57	8,760
5	714	16.8	75	105	25	250	....	....	....	....	200	21.01	42.70	26.70	4.48	21.30	....	69.2	6.57	3,000
6	725	20.3	40	55	13	62	....	....	....	....	324	17.88	172.50	46.90	9.52	53.30	....	55.2	23.82	8,240
7	750	25.3	75	100	30	48	14.1	18.8	....	....	309	30.87	96.10	37.90	9.61	31.10	7.4	57.0	13.39	6,900
8	1,100	11.2	82	75	33	24	4.0	4.8	....	....	212	15.82	49.00	32.70	3.65	23.10	11.6	68.4	7.30	8,758
9	1,300	21.6	75	58	25	75	....	....	....	....	227	13.10	120.00	32.00	6.92	52.90	....	66.7	17.64	8,300
10	1,300	15.6	145	111	49	82	14.7	10.1	17.0	17.0	161	17.91	61.60	44.00	6.87	38.30	6.9	60.8	15.02	8,760
11	1,450	10.3	145	100	45	135	6.0	4.1	....	....	74	7.40	37.10	35.80	3.71	50.00	10.3	90.1	4.98	8,760
12	1,500	21.0	50	33	25	62	11.4	22.8	25.3	25.3	500	16.70	204.30	32.40	6.81	40.90	10.2	68.1	13.00	8,760
13	1,500	22.9	90	60	15	34	14.3	15.9	23.7	25.0	167	10.00	98.70	25.80	5.92	59.20	7.5	80.6	11.53	8,300
14	1,500	16.5	110	73	37	47	15.0	13.6	31.2	38.0	209	15.33	81.10	36.10	5.95	38.80	8.3	56.3	16.96	7,200
15	1,534	15.9	195	127	65	62	19.9	10.2	15.9	15.9	308	39.10	60.80	48.60	7.73	19.80	6.8	61.3	7.63	8,760
16	1,550	23.2	70	45	18	....	....	....	....	....	314	14.18	200.00	38.90	9.03	63.70	....	83.6	10.46	8,200
17	1,700	15.5	175	103	43	67	24.0	13.7	21.5	27.0	131	13.50	73.00	48.60	7.52	55.60	7.6	81.8	10.13	7,000
18	1,775	22.5	125	70	18	....	....	....	....	....	240	16.90	151.00	47.20	10.64	62.90	....	90.6	5.97	8,760
Average—1915	1,137	19.3	89	78	29	79	11.3	12.1	20.1	22.2	239	17.08	99.06	35.47	6.70	43.27	9.1	72.0	11.68	7,502
1914	1,040	20.1	82	76	34	82	10.0	15.0	16.3	24.3	189	13.00	85.40	30.40	6.03	48.74	9.4	78.4	10.46	6,943
1913	1,290	15.9	86	67	34	70	17.0	20.3	19.8	32.6	219	13.15	93.70	34.70	5.35	42.80	10.3	75.8	11.06	5,960
GROUP II																				
19	2,500	19.1	140	68	35	31	27.0	19.3	25.9	27.0	185	10.40	124.60	36.60	6.98	67.10	7.7	57.4	28.61	8,400
20	3,300	23.0	170	52	34	....	45.2	26.6	25.4	25.4	300	15.45	130.80	29.30	6.74	43.60	5.6	60.7	17.15	8,760
21	3,500	17.1	200	57	40	....	25.1	12.5	....	....	500	28.60	100.00	33.30	5.71	20.00	9.1	....	.....	8,760
Average—1915	3,100	19.7	170	59	36	31	32.4	19.5	25.7	26.2	295	18.15	118.47	33.07	6.48	43.57	7.5	59.0	22.88	8,640
1914	2,720	17.1	208	75	58	58	29.0	16.0	23.8	24.2	208	14.15	90.64	37.43	6.18	47.96	8.6	66.2	15.73	8,629
1913	2,640	16.9	154	58	32	34	28.2	19.6	26.7	27.0	238	13.77	101.90	33.80	5.67	44.00	6.8	72.6	12.40	8,620
GROUP III																				
22	4,500	19.0	225	50	45	45	77.4	34.4	35.5	37.0	215	10.75	85.30	22.40	4.27	39.60	3.0	71.5	11.30	8,400
23	4,500	13.2	400	89	67	53	70.0	17.5	36.0	36.0	355	31.60	66.20	44.50	5.89	18.70	4.3	62.3	7.04	8,760
24	4,700	17.1	275	59	14	....	58.1	21.1	33.0	33.0	284	16.60	106.60	36.40	6.24	37.50	5.7	70.4	11.15	8,760
25	5,100	15.5	460	90	58	91	40.0	8.7	28.0	28.0	130	11.80	53.20	31.10	4.80	40.80	7.0	65.3	14.17	8,760
26	5,600	12.7	375	67	21	65	118.0	31.5	33.0	33.0	402	27.00	87.20	46.10	5.84	21.60	3.2	74.3	5.56	8,760
27	7,000	22.1	700	100	58	58	109.3	15.6	36.6	36.6	107	10.70	80.00	36.10	8.00	74.60	5.8	57.3	31.89	8,760
Average—1915	5,233	16.6	406	76	44	62	78.8	21.5	33.7	33.9	249	18.07	79.75	36.10	5.84	38.80	4.8	66.8	13.52	8,700
1914	5,494	17.4	367	67	33	65	74.5	21.8	26.4	26.6	302	19.17	106.09	38.74	6.59	39.77	6.1	66.5	11.38	8,701
1913	5,680	14.5	489	87	47	45	67.4	14.5	23.2	23.5	261	21.30	80.10	41.50	5.94	34.10	7.2	66.1	11.59	8,660
GROUP IV																				
28	10,000	9.1	900	90	100	58	126.9	14.1	35.2	35.2	182	16.45	45.10	44.60	4.06	24.70	3.7	65.9	8.42	8,755
29	11,700	14.2	750	64	24	44	133.0	17.7	31.2	31.2	468	29.90	97.40	44.00	6.24	20.90	6.3	68.2	6.63	8,760
30	12,560	18.1	810	64	14	....	227.0	28.0	37.0	37.0	267	17.20	115.10	41.10	7.42	43.20	4.7	49.0	22.00	8,760
31	12,850	12.1	1300	101	118	43	302.9	23.3	30.3	30.3	395	39.90	57.40	48.10	5.81	14.60	2.8	56.7	6.30	8,760
32	13,000	15.4	1950	150	72	118	171.3	8.3	29.3	29.3	377	56.50	47.30	46.10	7.09	12.54	6.1	47.5	6.59	8,760
33	15,785	6.3	1850	117	28	112	182.1	9.8	41.1	41.1	430	50.70	53.30	98.70	6.26	12.30	6.2	81.8	2.25	8,760
Average—1915	12,649	12.5	1260	98	59	75	190.5	17.0	34.0	34.0	353	35.11	69.27	53.77	6.15	21.37	5.0	61.5	8.70	8,759
1914	11,850	12.5	1217	103	68	93	187.9	14.3	31.1	31.1	362	30.89	64.42	51.20	6.19	19.47	4.7	59.4	7.86	8,760
1913	12,690	12.5	1225	103	53	86	171.6	15.0	32.9	32.9	423	44.10	68.20	45.18	5.96	15.62	4.6	54.6	7.32	8,760
GROUP V																				
34	25,000	11.1	1600	64	64	31	553.3	34.7	35.8	35.8	204	13.04	90.10	51.60	5.76	44.20	3.0	39.7	26.65	8,760
35	26,000	10.4	3500	135	167	95	500.0	14.3	21.7	21.7	137	18.46	45.70	59.30	6.16	33.30	3.7	55.9	14.69	8,760
36	30,000	16.8	2420	81	50	32	450.0	18.6	26.5	26.5	194	15.67	76.60	36.80	6.18	39.50	4.7	61.3	15.25	8,760
37	35,000	14.8	4200	120	79	44	748.0	17.8	35.7	35.7	298	35.70	57.90	47.00	6.94	19.40	3.7	45.2	10.64	8,760
38	42,000	11.5	9500	226	111	90	1230.0	13.0	30.0	30.0	157	35.50	27.30	53.50	6.17	17.40	2.4	59.9	6.97	8,760
39	105,538	12.1	10500	100	51	42	2332.0	22.2	32.8	32.8	285	28.50	76.00	62.40	7.57	26.50	3.9	43.0	15.12	8,760
Average—1915	43,923	12.8	5287	121	87	56	969.0	20.1	30.4	30.4	213	24.48	62.27	51.77	6.46	30.05	3.6	50.8	14.89	8,760
1914	48,500	10.8	4942	110	96	74	922.5	23.8	32.7	32.7	298	27.02	75.73	57.13	6.23	25.25	3.7	45.0	13.88	8,760
1913	46,830	9.5	4130	91	87	47	748.3	19.6	32.3	32.3	261	22.40	72.50	69.20	5.80	28.20	3.9	47.1	14.78	8,760
Grand Ave. 1915	10,272	16.9	1124	86	45	70	232.2	16.8	28.3	29.0	258	21.23	87.34	40.70	6.43	37.20	6.4	65.5	12.59	8,135
1914	8,920	17.1	856	82	46	74	177.9	17.7	24.5	26.9	242	18.52	86.10	38.70	6.19	40.99	7.2	66.7	11.73	7,998
1913	9,470	14.6	819	77	45	56	152.0	18.3	24.9	29.5	251	18.45	87.30	41.00	5.78	37.25	7.6	67.8	11.60	7,610

definitely explain what appeared to be unusual conditions and also to define certain of the terms used:

The population of districts comprises total population of all cities, towns and communities served, estimated to the nearest 100. Low factors in the number of consumers per 100 population may be caused in some cases by counting outside towns as one consumer each, when the generating company does not operate the distribution system in the outside towns. The station rating in kilowatts includes in some cases the total rating of all main generators, whether they could all be operated at the same time or not. When energy is received over a transmission line the kilowatt-rating of the substation is given. The station rating per capita in watts is likely to be high where new generating equipment has recently been added or in the case of water-power plants with steam auxiliary equipment. The station rating per employee is likely to be high for the same reasons that station rating per capita is high, and also it may be true that some reports did not take into account office employees. The item, ratio of station rating to connected load in per cent, requires total connected load for calculation, and it is probably true that the total connected load was derived from estimates rather than from accurate records in more instances than for any other

TABLE IV—ADDITIONAL AVERAGE FACTORS

Group Number	Population	Annual Kw.-hr. Made per Capita	Annual Kw.-hr. Made per Consumer	Expenses per Kw.-hr. Made, Cents	Gross Income per Kw.-hr. Made, Cents
Group I.....	1,137	75	387	6.6	9.1
Group II.....	3,100	90	458	4.4	7.5
Group III.....	5,233	131	789	3.2	4.8
Group IV.....	12,649	132	1055	3.1	5.0
Group V.....	43,923	193	1510	1.8	3.6
Grand average 1915	10,272	184	1090	4.2	6.4
Grand average 1914	8,920	159	933	4.8	7.2
Municipal, 1915....	3,021	121	617	4.4	6.6
Municipal, 1914....	2,513	98	537	5.5	7.9

quantity involved in the whole report. The average load during operation in kilowatts is the total kilowatt-hours at the station divided by the total hours of actual operation. The ratio of average load to station rating in per cent is likely to be low when station rating per capita is high. The annual load factor in per cent is the actual kilowatt-hours of output for the year divided by the kilowatt-hours output if the station were operated at peak load during every hour of the year. The operating load factor in per cent is the ratio of the average load during actual operation to the peak load, and if the station operates every hour of the year the operating and annual load factors are the same, but when a station is shut down part of the time the operating load factor will be the higher of the two. The investment per kilowatt of rating shows wide variations in local conditions. The investment per capita should indicate something of the sufficiency of the plant to care for the future. The gross income per kilowatt of rating depends largely upon average rate and ratio of average load to station rating; gross income is supposed to include money received from sales of electric energy. Gross income per consumer should indicate how well the business has been developed. Gross income per capita depends largely upon the rates and ratio of consumers to population. Gross income per $100 invested is naturally variable, likely to fluctuate with expenses and likely to be low in case the market has not been developed, for recent additions to equipment and in case of new stations. Gross income per kilowatt-hour depends largely upon rates, distribution, losses, etc. Ratio of expense to gross income in per cent should indicate how successful the operation of the plant has been; the expense is supposed to include operating expenses, taxes and insurance, but no interest or depreciation. Earnings from operation for $100 invested, interest and depreciation not deducted are interesting as showing the great variation in the income which can be applied to paying for depreciation, interest, dividends and surplus. When there is less than $760 total hours of operation per year continuous service is not supplied.

Austin Burt of Waterloo was chairman of the committee and F. A. Fish and H. W. Wagner of Ames were the other members.

The Daylight Saving Movement

Psychological and Practical Aspects of the Proposal to Set the Clock Ahead by One Hour During the Summer Months

BY DR. LOUIS BELL

By all the signs of the times the "daylight-saving" movement, which year after year has been urged in Great Britain through proposed acts of Parliament and invariably turned down, is coming to the front with a more serious backing than ever before. In fact, the French Chamber last month passed an act looking to its adoption. Several Canadian towns have adopted the scheme, and it is even being seriously considered in a few American cities. As it was originated with special reference to economizing in the use of artificial light it has a direct interest to the central station man, and is worth considering both for this reason and upon its merits as a possible reform in the world's conventions regarding time.

Briefly, the daylight saving movement is an attempt to adjust the hours of human activity to coincide as well as possible with the hours of daylight furnished by nature. As everybody knows, in the latter part of June it is sun-up over most of our country at about 4.30 o'clock in the morning, and sun-down at approximately 7.30, while in late December the sun rises at about 7.30 a. m. solar time, and sets at about 4.30 p. m. The length of the day thus varies from a little more than fifteen hours to barely nine. The proposal of the daylight saving advocates is that during the long days all clocks should be set forward an hour, so that the unsuspecting citizen would turn out as usual, say, 7 o'clock normal time, and be really arising at the unwonted and undesired hour of 6. As a result he would, in fact, begin his day's work an hour earlier and close it an hour earlier. Then, by going to bed one disguised hour earlier than is his custom, hence one hour nearer to sunset, he would be able to save the artificial light which he might otherwise burn. When the days get shorter the time would be flopped back to its original status, and everything would go on according to the ordinary schedule. Obviously the shift in time would do no good in winter, because what would be gained in artificial lighting at one end of the day would be lost at the other. The scheme of getting up early when the birds are singing, the dew is on the grass, and all that sort of thing, is an old one and highly recommended by those who do not have to do it. But it has never been popular among people at large. In fact, the writer remembers in his boyhood days an old farmer reputed to be the meanest man in his county, who is said to have made his faithful spouse get up even on summer mornings to hold the lantern for him while he mowed, that he might put through the day's work earlier.

The present form of the early-rising propaganda depends on the psychology of the clock, the moral effect of having that monitor of one's habits lie plausibly in the interest of early rising. As a matter of fact, for about six months onward from the middle of April, when

the sun rises not far from 5.30 o'clock, the customary hours of labor would fit the scheme fairly well. In effect it would merely shift working hours to a point earlier in the day, and all the benefits which might be supposed to arise from the plan would be equally secured by actually starting business hours of every kind an hour earlier in summer than in winter. Altering the clock merely changes the place and keeps the pain, and whether it would be any more popular by that reason remains to be seen. If changing the clock were made compulsory it certainly would rouse a storm of indignation, just or unjust, in precisely the same way that many people, including the trades unions, would be likely to protest vigorously against a shift in the actual hours of activity.

As a matter of economy the value of the proposition is rather dubious, and the central station operator certainly need not fear any large inroad upon his receipts. The summer months are lean months in the lighting business. Nobody uses light in the morning, and the call for illumination in the evening is the only thing which would be effective. Even so it is rather doubtful whether the ordinary family would, in fact, economize to any noticeable extent. The head of the house, weary from labor, might, indeed, turn in an hour earlier than usual, but the younger members of the family, who usually determine the hours of artificial lighting, would very likely take the opportunity of sitting up till official midnight, instead of following the good example of *pater-familias*. All the ordinary places of entertainment operate by artificial light irrespective of the sun's daily course, so that nothing would be gained or lost on their account. The suggestion of economy is ingenious rather than convincing, and the central station industry has no couse to tremble in its boots as to the possible result of the innovation. Street lighting would go on through the hours of darkness as usual, and the general course of central station load would remain unaltered, save in minor particulars. Night work would continue to the same extent as now, offices and shops would in general require neither more nor less artificial lighting in dark corners, and the use of motors and all electrical appliances would be quite unchanged.

Meanwhile there are some material inconveniences that would be brought by a compulsory change of timepieces. Railway schedules and all things of human interest which occur at particular hours would have to be adjusted twice a year on the fateful day of change, and the proposed shift of an hour does not fit in very well with the standard time belts, which have proved so great a convenience to the country. Within these there is a half hour variation each way from the mean solar time, which of itself has proved enough of an inconvenience to cause some cities even now to carry their local time as well as the standard conventional time. With respect to sun time, therefore, the change would mean a clock variation not as now of half an hour at each side of the belt, but would give a full hour plus or minus the present variation, as the case might be. In other words, the schedule proposed does not fall in very well with the standard time now in use, arranged as it is in 15 deg. belts. In England, which covers a scant 8 deg., or even in France, which covers 11 deg., the program would work out more smoothly. It is not so conveniently adapted to our wide-stretching country. At all events, it would seem wise policy to let the other fellow try it on before plunging into further horological mendacity in the hope of a dubious economy.

"Never Too Old to Wire!"—Houses Built in 1660 Now Equipped for Electric Lighting

Competition is running high between some of the progressive central stations of New England in the wiring of ancient houses. At present the Cambridge (Mass.) Electric Light Company seems to have carried off the palm for wiring the oldest house, although the Plymouth (Mass.) Electric Light Company is a close second. The Cooper-Austin house, at 21 Linnaean Street, Cambridge, built in 1657, and the oldest residence now standing in the city, has been wired this year, and is now a customer of the Cambridge company. The installation includes twenty-two 15-watt and six 25-watt tungsten lamps, with eight receptacles. The service is from the company's overhead lines, through the usual pipe conduit, which, as illustrated, enables the leads to be carried into the house with minimum disturbance of its appearance. A Colonial porch lantern equipped with a 25-watt lamp is another appropriate feature. This house remained in one family for a period of 250 years. Herbert A. Holder of Roxbury, Mass., was the wiring contractor.

The oldest house in Plymouth, Fig. 2, is located at 8 Winter Street, and was built in 1666 by William Harlow. It is now occupied by three sisters, who became interested in electric service through a house-wiring campaign display of the Plymouth company at its offices. Three rooms have been wired so far, with nine 25-watt lamps all told, including the front hall, dining room and front room. An overhead service is provided, and the wiring contractor was Winthrop Rogers of Plymouth. In both the above houses the chimneys have withstood the ravages of time with the need of little or no alterations.

THE OLDEST HOUSE IN CAMBRIDGE, MASS.—BUILT IN 1657 WIRED FOR ELECTRICITY IN 1916

PLYMOUTH (MASS.) HOUSE BUILT IN 1666 AND RECENTLY WIRED FOR ELECTRIC SERVICE

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Effect of Change of Load Factor on Station Operating Expenses

Data on the relation of fuel, labor and repair expenses to the total cost of station operation are presented herewith for two New York electric service companies. These figures do not include overhead charges such as interest on investment, depreciation, amortization, obsolescense, taxes and similar items, which raise the total expense of delivering energy to the switchboard considerably.

The data relating to the operating expenses of one of the Rochester Railway & Light Company's generating stations are especially interesting, since they show the effect of change in load factor on the station costs and distribution thereof. For the particular conditions referred to, the total operating cost at the low load factor was 7.8 times that at the higher load factor. The load factors are given for both the electric and steam loads, since the data relates to a station supplying high and low-pressure steam for industrial and heating purposes as well as electrical energy. While the electric load factor dropped from 25.56 per cent to 3.18 per cent the steam load factor only dropped about 6.5 per cent, thus serving to stabilize conditions.

Station Items	Rochester Railway & Light Company		Central Hudson Gas & Electric Co., Poughkeepsie, N. Y.	
Load factor, electric (per cent)	25.56	3.18	42.7	36.2
Load factor, steam (per cent)	32.19	25.71	.....	.....
Coal (pound per kilowatt-hour)	2.475	9.448	4.24	3.95
Evaporation (pound water per pound coal)	9.3	9.04	7.68	6.64
Fuel expense (per cent)	54.0	30.0	65.0	64.0
Labor and superintendence (per cent)	31.0	48.0	18.44	17.30
Repairs	15.0	22.0	13.02	15.40
Supplies	.....	.....	3.54	3.30
Relative total production cost	1.0	7.8	.....	.....
System peak (kilowatts)	.....	.....	3560*	3360*

*1915 peak, 4900 kw.

The information tabulated herewith was presented at a recent meeting of the Empire State Gas & Electric Association by R. D. DeWolf, mechanical engineer of the Rochester Railway & Light Company, and H. Flood, Jr., of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y. Reports from another company, which purchases part of its energy and generates the remainder, show that labor, fuel and other expenses are in the ratio of 20 to 55 to 25.

Plain Poles Versus Poles with Steps

At a recent safety meeting of linemen of the Central Illinois Public Service Company held at Beardstown, Ill., a spirited discussion centered around the desirability of adhering to pole steps. The matter was considered from the viewpoint of "safety" and not "convenience." Of the thirty-two men present twenty voted for steps and six voted against them.

Some of the reasons advanced for adhering to steps were that they were convenient in cases of fire or where necessary to pull primary plugs in emergency cases, when linemen are not equipped with spurs; they enable prolonged life of the poles so equipped, it being known that the use of climbing irons has a deleterious influence upon pole-life, and are safer for the men, especially in slippery weather. The reasons for abolishing steps on poles were that steps are more dangerous; they are slippery when covered with sleet; they constitute a serious hazard should a man "burn" or "shin" a pole; they are useless.

The motion that poles having primary cut-outs be equipped with steps was carried by a vote of twenty to six, while the motion that all pole steps be eliminated from pole lines carrying anything above 2300 volts, as a matter of safety only, was carried by a vote of twenty-two for removal to three against.

Construction of a Water Rheostat Capable of Carrying 700 Amp.

By C. L. Kasson

A water rheostat capable of handling 2200 volts and currents up to 700 amp. has been constructed by the Edison Electric Illuminating Company of Boston to control a 1000-kva. 2200/50,000-volt transformer used in its testing laboratory. The rheostat is equipped so that the immersed surfaces of the electrodes and the distance between them may be increased or diminished independently of each other. As the water has to be added continuously to prevent boiling, special means are provided to maintain the supply.

The tank is about 3 ft. wide by 3 ft. deep by 8 ft. long, and is made of 3-in. cypress. At one end of the rheostat are two 0.5-in. perforated vertical pipes, which admit water to the tank. This method of delivering water tends to equalize the temperature of water in the tank better than if water were admitted through only one large orifice. Water is allowed to overflow at the opposite end of the tank, where a spillway with a sloping face is provided. Means are also provided so that a salt solution of known concentration can be injected into the water at varying rates. The solution is ad-

FIG. 1—WATER RHEOSTAT USED BY BOSTON COMPANY

mitted in fine jets playing against the jets of incoming water, thus insuring a uniform mixture.

Each electrode consists of twenty-one copper rods ⅝ in. in diameter and 3 ft. long attached 1½ in. apart to a frame, thus forming a copper grid having an area about the same as the cross-section of the tank. These grids have the advantage, however, that they will not

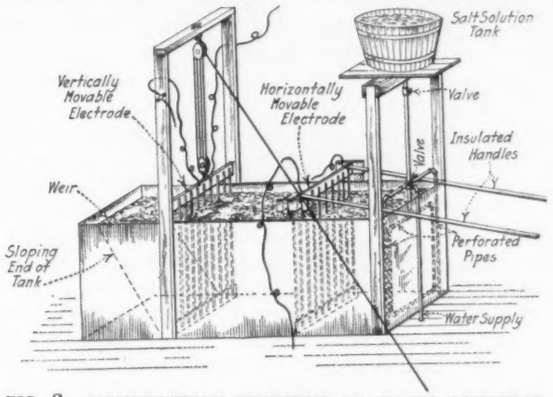


FIG. 2—CONSTRUCTION FEATURES OF WATER RHEOSTAT

impede the flow of water longitudinally through the tank as a solid plate would, thus reducing boiling to a minimum. One electrode is suspended from a block and tackle attached to a wooden gallows over the tank. The other is supported on a carriage, which can be moved along the top edge of the tank. Experience with this water rheostat has shown that it will easily control the voltage of the test transformer within variations of 1 per cent.

Solution of Telephone Interference Trouble by Sectionalizing Overhead Ground Wire

BY J. N. CADBY

Division Engineer, Gas, Electric and Telephone Division, Railroad Commission of Wisconsin

High-voltage transmission lines frequently cause considerable disturbance to so-called grounded telephone systems, although there may be no instances in which the two sets of wires are parallel for long distances. Transmission engineers hold that the grounded telephone system is obsolete, and the owners of the small grounded telephone systems stubbornly insist that their lines were all right before the power lines were constructed and that since that time it has been practically impossible to use the telephone.

The Wisconsin Legislature has given to the Railroad Commission authority to investigate cases of this kind and to order changes in construction or methods of operation, and to apportion the costs of such changes between the power and the telephone interests. One of the first cases to come before the Railroad Commission of Wisconsin under the new law (Chap. 61, laws of 1915) was brought by the Bangor Telephone Company against the Chicago, Milwaukee & St. Paul Railway. That railroad company uses alternating current for operating its signal system, purchasing current at 4400 volts from electric utilities along its line. Above this 4400-volt supply line a continuous ground wire is strung for protection against lightning. This is located about 2 ft. from the conductors of the power line and is grounded at every tenth pole.

The telephone lines are half a mile away from the power line, except for a short distance in the village. The lines that supply service to subscribers located near the railroad, 4 or 5 miles away from the exchange, are the ones that have been noisy since the signal system was put in operation. It appears that the return circuit passes into the earth, but that the overhead ground wire of the power line forms a part of the circuit between the ground connections nearest the distant subscribers and those nearest the exchange.

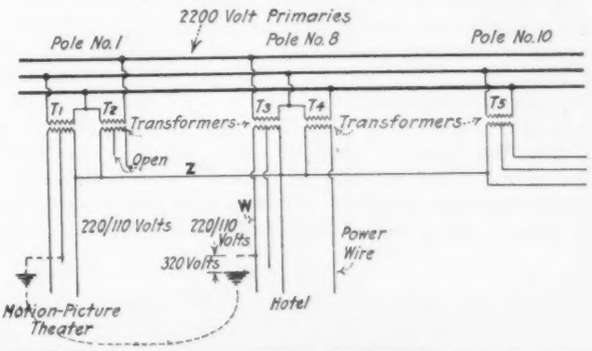
At the hearing in the case there was some speculation as to what caused the interference and the commission ordered tests to be made by a member of its engineering staff and representatives of the parties to the case. The continuous ground wire was cut at a point near the exchange and the noise on the telephone lines was reduced to such an extent that the representatives of the railroad company decided to permanently install strain insulators, dividing this overhead ground line into a number of sections, and to remove the ground connections nearest the exchange.

It is believed that many similar situations would be relieved if the overhead ground wires above the power lines were divided into sections in this manner, or if the ground connections of the two systems were separated by a sufficient distance so that the overhead ground wire does not form an important part of the telephone return circuit.

Peculiar Voltag· Conditions on Lighting Circuits Due to Incorrect Transformer Connections

BY GEORGE W. TEFFEAU, JR.

Peculiar conditions often arise in connection with the operation of central-station systems that call for considerable study in working out a solution. An interesting case came to the writer's attention recently when a complaint was received from a new hotel reporting that a plumber had come into contact with one of the three wires feeding the lights and had received a severe shock. A troubleman inspected the installation and reported high voltage in the building based on the fact that he had burned out two 220-volt lamps while testing from one outside wire to ground. The writer made tests with a voltmeter and found the following conditions at the



CONNECTIONS OF TRANSFORMERS RESPONSIBLE FOR PECULIAR VOLTAGE CONDITIONS

three blades of the service switch: The voltage across the two outside blades was 220; between middle and either outside blade, 110; between one outside blade and ground, 165; between the other outside blade and ground, 320, and between middle blade and ground, 220 volts. Since the transformer feeding the lighting circuit was connected 200/110-volts, it was at first assumed that the insulation had broken down. To safeguard against the high voltage a ground wire was connected to the middle blade of the service switch while further tests were being made. Shortly after connecting the ground wire a report was received from a nearby customer stating that a motion-picture machine rectifier was out of order and that everything in the operating booth was alive. Tests were made at this

installation also, and the same conditions discovered that existed at the hotel. Since the motion-picture house circuit was fed from a different transformer and apparently not connected to the hotel transformer in any way, the case was a puzzling one.

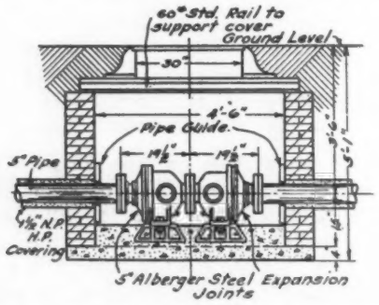
The distribution system circuits were finally traced and the conditions causing the trouble found as shown in the accompanying diagram. It was discovered that the wire Z was connected to five transformers. As soon as this wire was removed and the transformers cut apart the ground disappeared and conditions became normal. Further investigations revealed that transformer T_4 had recently been installed and the fourth wire for power service for the hotel had previously been supplied from transformer T_3. When transformer T_4 was installed, the construction foreman overlooked cutting it apart.

From the diagram it will be observed that a ground on the middle wire of transformer T_1 gave the potential of 320 volts from the outside wire of transformer T_3 to ground, because there was all of the secondary winding of the transformer T_3 and half of the secondary winding of transformer T_1 in series with the circuit established by grounding the wire W from transformer T_3.

Since it is common practice to phase a transformer with its nearest mate to get a fourth wire for a 220-volt power service, and at the same time use the transformers for 110-volt lighting, it is necessary to exercise some care and know definitely just what conditions are involved. The writer has known of cases where as many as eight transformers were placed together because the line foreman had continued to pick up the power service wire from the next nearest transformer each time a new transformer was installed in a growing section. This is therefore a point for line foremen to observe when installing new service.

Compensating for Pipe Expansion in Small Space

Offsets and flexible loops cannot always be used to compensate for steam pipe expansion and contraction because sufficient space may not be available for their installation. Where this is the case, expansion joints may be employed within certain limitations. According to an article by C. G. Binder in *Gas & Electric News*, the latter method of providing for pipe movement was used recently by the Rochester Railway & Light Company in constructing a pipe line to serve one of its customers with steam for heating purposes. About



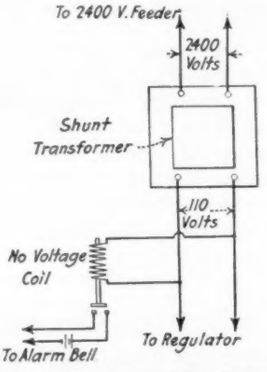
SECTION OF PIPE LINE CONTAINING EXPANSION JOINT

227 ft. of the pipe is 5 in. in diameter, and 250 ft. of pipe is 3 in. in diameter. The steam pressure is 100 lb. Since steel pipe elongates about 0.008 in. per 100 ft. of length for each degree Fahrenheit rise in temperature, and since the pipe in this case is subjected to a temperature range of 50 deg. Fahr. to 288 deg. Fahr. in winter, it was necessary to provide for a variation in length of almost 11 in. This was done by inserting Alberger steel expansion joints in the pipe at four manholes between the termini, as shown in the accompanying drawing. Each of these joints is capable of caring for 2-in. movement. The type of joint employed consists of a number of circular chrome-vanadium steel disks welded together at their peripheries in such a manner that they form a bellows. As indicated, the joints, as installed, occupied a space in each manhole 39 in. long by about 18 in. in diameter.

Alarm System to Indicate Feeder Service Interruptions

BY R. H. RICHARD

A Western electric service company has found it advisable to use an alarm bell to notify operators of an interruption to service on its 2400-volt feeder circuits. Since the mounting and design of the oil switches did not facilitate attaching a simple alarm switch thereto a no-voltage release coil was connected, as shown in the



NO-VOLTAGE RELEASE COIL CONNECTED WITH SHUNT TRANSFORMER TO OPERATE AN ALARM BELL

accompanying drawing, with the shunt transformers used in conjunction with each regulator. When the coil is energized its contactor opens the alarm-bell circuit. When service over the feeder is interrupted the reverse condition takes place and therefore causes the bell to ring. A motor operated horn might be used and serve as an effective signaling device.

Some Considerations in the Operation of Low-Pressure Steam Turbines

BY W. J. LIVINGSTON

An interesting example of the use of low-pressure steam turbines is found in the Rankin station of the Duquesne Light Company at Pittsburgh, Pa. In this station two 1500-kw. and one 3000-kw. low-pressure turbo-generators are operated with a vacuum of 28 in., using exhaust steam at 15 lb. to 18 lb. abs. per sq. in. pressure, from nine cross-compound engines of a total rating of 5750 kw. The steam engines exhaust into a header with branch pipes leading into three receivers, one for each turbine. From these receivers the steam goes to the turbines through a constant-pressure valve and is exhausted to Leblanc condensers. The constant-pressure valve keeps the receivers above atmospheric pressure so that no air can get into the system. During operation of the turbines it is usually the case that the governor valves are open wide so that the turbines can be kept fully loaded and the excess steam used in a feed-water heater. Careful attention is given to this use of the exhaust steam from the steam engines

so that no steam goes to the atmosphere. The total rating of the steam engines and the low-pressure turbines is 11,750 kw.

The considerations which determined the selection of the low-pressure turbines for the installation mentioned were as follows:

1. An increase of about 100 per cent of the maximum capacity of the steam-engine equipment.

2. An approximate increase of 25 per cent in the overall efficiency of the plant and a saving of approximately one-half the investment necessary to build either a high-pressure turbine or reciprocating-engine installation of the same capacity.

3. The first cost of condensers and turbines and high vacuum required for economical operation was less for the low-pressure installation.

4. The fuel and ash-handling equipment required by the engine installation could be used.

By the installation of the low-pressure turbines the following, in the order of their importance, are the operating advantages among those considered that have been secured:

1. The economy of operation not only of the added units but of the existing engine units has been raised so that the combined efficiency of the plant is at least 25 per cent higher.

2. The operation of additional boilers and all items of cost in connection with additional fuel and ash-handling apparatus have been eliminated.

3. A larger reduction in the estimated amount of condensing water required per unit of capacity in the case of additional steam-engine-driven units operating at the same vacuum has been possible.

Among the disadvantages that were considered in selecting the low-pressure turbine was the high first cost of piping, valves and fittings as compared with those required for other types of machines. This high first cost was due to the fact that steam at low pressure of 15 lb. to 18 lb. abs. per sq. in. had a high specific volume, and although a rather high velocity was allowed, a 22-in. steam line was required for a 1500-kw. turbine. It was necessary to run this line the full length of the power house, and on account of the size special considerations in covering were necessary in order to reduce the loss due to radiation as much as possible. Even after allowing for a large first cost of the piping, the low-pressure installation was in this case much cheaper than either the high-pressure or the reciprocating types.

The exhaust line from each of the steam engines is fitted with a Schutte back-pressure valve which automatically opens when an engine is put in service and closes when the engine is taken off the line. The exhaust steam from the engines contains considerable moisture and is carried to a separator installed near each turbine. These separators are built especially for low-pressure service and collect not only moisture but as much oil, grease and dirt as possible in the exhaust steam. From calorimeter tests it has been found that the moisture passing through the separator does not exceed 2 per cent.

From a condensation test made before the exhaust line was covered with insulating material, it was found that the total condensation in the low-pressure cylinders and the entire exhaust line amounted to approximately 10 per cent of the total amount of steam supplied to the reciprocating units. The separators and large low-pressure steam line contain a total capacity of 3000 cu. ft. and serve to smooth out any small variations in the supply and demand of steam. If the total amount of steam contained at any instant in the low-pressure system could all be supplied to one of the 1500-kw. machines, it would carry a full load just nine seconds. The low-pressure system is equipped with a 30-in. automatic release valve and a free exhaust head, so that if for any reason the steam supply is in excess of the demand, the pressure will not rise above the predetermined amount.

While each turbine receiver is designed to take care of oil and water that may be present in the exhaust from the main engines, careful attention is given to this matter to prevent oil and foreign matter choking the steam passages through the turbine blades. Pure, clean oil in itself will pass through the turbine without accumulating, but in cases where the boilers sometimes foam, discharging sulphates, carbonates or other solid matter with the steam, this material mixes with the oil to form a gummy deposit on the blades which is difficult and expensive to remove besides reducing the efficiency of the units. It is necessary to examine the blades of the turbines every six or nine months. In examining the rotor blading of the turbines installed by the Duquesne Light Company it has been found that some of the stationary bladings become coated with a gummy substance, particularly the first two or three rows of stationary blades.

Special attention is given to the operating vacuum of the turbines and 28 in. of vacuum is maintained. When running with this vacuum and an inlet pressure of 1½ lb. per square inch the steam consumption for the turbine is 32 lb. per kilowatt-hour. If the vacuum is allowed to drop to 27 in., the steam consumption is increased about 8 per cent, or to about 34.6 lb., which with a 1500-kw. machine increases the amount of steam used per hour 3840 lb.

A Method for Placing Wires in Flush-Switch Boxes

In removing or replacing the bare ends of wires where they attach to the binding posts of flush switches, the wire ends often break off just at the point where they leave the insulation. This frequently causes trouble for the wireman in making new connections to the binding posts, in that the wires are then usually 0.5 in. or so too short. Such an occurrence can be prevented if, at the time when the original installation is made, the wires are looped within the switchbox as shown in Fig. 1.

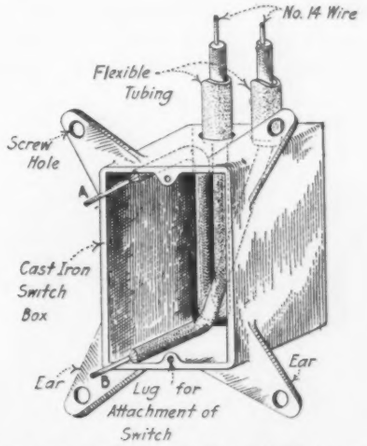


FIG. 1—WIRES ARRANGED IN SWITCHBOX TO ALLOW FOR SHORTENING BY BREAKS WHEN MAKING CONNECTIONS

It is obvious from the illustrations that, should the wire ends break off as already stated, there will still be sufficient wire in the box to allow for making a new connection. By reversing the positions of wires *A* and *B*, each wire will be extended 2 in. or 3 in., thus allowing the wireman to easily make new connections, even though an inch or more of the wires break off.

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

How Dayton Cashed In on "Wire-Your-Home" Month

Eight Hundred Old Houses Were Wired, $34,000 Was Turned into the Coffers of Electrical Contractors, and a New List of Live Prospects Was Secured by Five Weeks' Concentrated Effort

The Dayton (Ohio) Power & Light Company was one of the first companies to appreciate the advisability of developing a flat-rate-per-outlet house-wiring proposition in co-operation with local electrical contractors as a means of assisting its residence salesmen in securing contracts for the wiring of old houses. During the years of 1914 and 1915, 2565 old houses were wired in Dayton, and the company in the last three years has added 7215 customers. It was believed, however, that "Wire-Your-Home" month could be made to produce many more.

The schedule reproduced on this page has applied in Dayton during the years mentioned, and under this arrangement the salesmen of the company secured the business and turned the wiring contracts over to the contractors in alphabetical rotation. The contractors financed the house wiring on the basis of 20 per cent paid when the contract was executed and the balance in easy payments, the customers being allowed five months in which to pay in full.

AGREEMENT WITH CONTRACTORS LOWERS PRICES

With the announcement of the national "Wire-Your-Home" month campaign, the Dayton Power & Light Company at once made plans to "cash in" on this national movement and arranged a special wiring offer with the co-operation of eight of the leading electrical contractors, all of whom maintain stores and are electrical dealers. In consideration of the fact that the company would secure the contracts, conduct a live publicity campaign and finance the wiring contracts, the contractors agreed to do the work for 15 per cent less than the regular schedule of prices. As an additional inducement the company agreed to allow an extra 5 per cent discount on all bills paid upon completion of the work. On all contracts a payment of 10 per cent of the cost of the work was required upon the executing of the contract, the balance to be paid in twelve equal monthly installments. The commercial manager of the company, Thomas F. Kelly, had estimated that 200 wiring contracts would be closed in Dayton during the month and detailed four salesmen for this work.

SCHEDULE

Price-List Form of Outlets and Hardware

GENERAL—All openings for switches, receptacles, drop cords and fixtures are considered as outlets, and based on a Unit price for houses of different classes of construction.

The cost of switches, receptacles and drop cords should be added to the price of outlets, and this sum will be the contract price for all labor and material necessary to complete the work as outlined in the schedule.

All extra outlets, switches, receptacles and drop cords will be charged for at the rates according to the class of house for which the contract is written.

OUTLETS

No. of Outlets	Class A Single Flooring	No. of Outlets	Class A Single Flooring
8	$24 03	24	$65 39
9	26 23	25	66 93
10	28 43	26	68 47
11	29 97	27	70 01
12	31 51	28	71 55
13	33 08	29	73 38
14	34 59	30	75 16
15	36 13	31	76 97
16	37 67	32	78 77
17	39 21	33	80 37
18	40 78	34	82 37
19	42 29	35	84 18
20	43 83	36	85 98
21	45 37	37	87 79
22	46 91	38	89 59
23	48 45	39	91 40
24	49 99	40	93 20
25	51 53	51	95 00
26	53 07	52	96 81
27	54 61	53	98 61
28	56 15	54	101 41
29	57 69	55	102 22
30	59 23	56	104 02
31	60 77	57	109 83
32	62 31	58	107 63
33	63 88	59	109 43
		60	111 24

CLASS B—MIXED FLOORING

PRICES AS PER CLASS A, EXCEPT AS BELOW:

Located under double flooring, 2nd or 3rd story:

Ceiling outlet ..... $1 00 extra
Switch outlet (controlling any center outlet) ..... 1 00 "

Located under hardwood flooring, 2nd or 3rd story:

Ceiling outlet ..... $3 00 "
One switch outlet (controlling any center outlet) .... 3 00 "
Additional switch outlets on same gang (controlling same center outlet) each ..... 1 50 "

CLASS C—MIXED WALLS

Outlets appearing on brick walls ..... $4 50 "

HARDWARE

Push button switches, each	$1 25
Push button, 3-way switches, per set of two switches	3 50
Push button, 4-way switch	2 45
3-way snap switches, per pair	1 95
Porcelain base switches, each	50
Porcelain base Edison receptacles, each	30
Bryant flush-plate receptacles	80
Chapman flush-plate receptacles, each	1 15
Drop cord key socket, each	65
Drop cord chain socket, each	85

THE UNIT-COST SCHEDULE OF THE DAYTON CAMPAIGN

METER TESTING MEN CALLED IN TO HELP SELL

On Wednesday, March 15, a special advertisement announcing the campaign was run in the two evening papers. A similar announcement appeared in the morning paper on the following day. The telephones in the sales department of the company worked overtime from

ONE OF THE MANY OLD BRICK HOUSES WIRED AT DAYTON DURING THE CAMPAIGN

A THIRTY-YEAR-OLD FIVE-ROOM COTTAGE EQUIPPED FOR ELECTRIC SERVICE THIS SPRING

8 o'clock Thursday morning, March 16, until Saturday, April 15, with people asking to have salesmen call on them to estimate the cost of wiring their homes. In fact, because of the large number of inquiries received and the necessity of giving prompt attention to them, Mr. Kelly found it necessary by Tuesday, March 21, to secure the temporary services of six bright young men from the meter testing and maintenance departments of the company. These men were competent wiremen, and with a little coaching were "turned loose" on the mass of inquiries, with the result that the Dayton Power & Light Company in Dayton alone during "Wire-Your-Home" month secured 556 wiring contracts. These came in day by day as follows:

Date	Contracts	Date	Contracts
March 15	0	April 4	18
16	0	5	20
17	4	6	21
18	1	7	15
20	5	8	31
21	2	10	24
22	5	11	27
23	10	12	27
24	14	13	41
25	16	14	40
27	18	15	40
28	16	17	17
29	15	18	12
30	19	19	14
31	14	20	6
April 1	19	21	9
3	19	22	17
Total	556		

This was the result of the work of eight salesmen, for with the advent of the six temporary salesmen regular salesmen were released for other work in Dayton and the other towns.

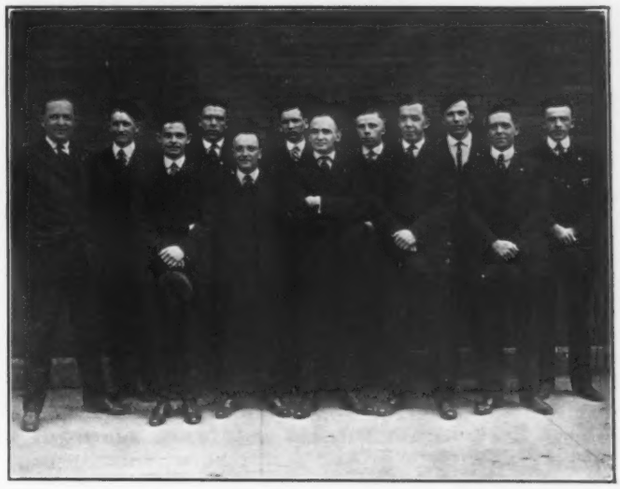
INCREASED BUSINESS TO CONTRACTORS

In addition to the 556 contracts above mentioned, the eight contractors who were co-operating with the company secured approximately 200 contracts for wiring old houses. It is figured also that the other wiring contractors, those who have no stores—and the "curb stoners"—secured 124 contracts. It is conservatively estimated, therefore, that altogether 880 contracts were closed for the wiring of already-built houses in Dayton during the month. The cost of wiring the 556 houses contracted for by the company totaled $23,953.51, an average of $43.09 per house, which, of course, does not include the fixtures. At the same average cost per house the total revenue received by all contractors as a result of the campaign would be $34,472.

PROBLEMS OF THE CAMPAIGN

When the campaign was started Mr. Kelly had in mind that possibly 200 wiring contracts would be secured, and he offered a dinner and a theater party to the salesmen in the event of 300 wiring contracts being won. It is interesting to note that this number had actually been signed up by April 10. Another notable feature of the campaign was the fact that every contract was closed in the following up of inquiries which had been received in response to the newspaper advertising. For while it had been the intention to conduct a house-to-house canvass when the campaign was inaugurated, the men soon became too busy following up live inquiries to undertake the work. As can be imagined, many more inquiries were received which did not result in contracts, and, of course, these inquiries now form an invaluable list of really "live" prospects.

Another interesting point developed in the question as to how to pay the temporary salesmen, in view of the fact that ordinarily these men would be entitled to time and a half for overtime work in the evening, which was the best time for closing a large number of wiring contracts. This question was settled by paying them regular time for day work and a commission of 50 cents for every wiring contract secured in the evenings.



THE MEMBERS OF THE DAYTON SALES DEPARTMENT WHO BROUGHT SUCCESS TO THE CAMPAIGN. COMMERCIAL MANAGER KELLY STANDS FOURTH FROM THE RIGHT

The campaign created an immense amount of interest throughout the city and the news spread far beyond. Contracts were secured by correspondence with home owners living in Great Falls, Montana and Springfield, Ohio. Other owners made trips to Dayton from Cincinnati and Springfield, Ohio, to close contracts. The publicity campaign which was responsible for this included advertising in the following local newspapers: The *Dayton Daily News*, the *Dayton Evening Herald*, the *Greater Dayton Gazette* (a German paper), the *Miami Valley Socialist*, and a weekly paper for colored people. In addition to the newspaper advertising, more publicity was secured through the distribution by salesmen of house-wiring booklets secured from the lamp companies, inclosing a reply postcard, and good live window displays pertaining to the campaign were featured both in the company's and the contractors' windows.

As a result of the timely newspaper copy run about April 13, many new inquiries were received, and as it was impossible to interview all these new prospects by April 15, the company accepted contracts signed up to and including April 23, providing the person executing the contract had made inquiry prior to April 15. This time extension resulted in the company securing seventy-five additional wiring contracts.

An Electric-Shop "Opening" Souvenir, Good for 50 Cents on Appliance Purchases

To mark the opening of its new electric shop at Eighty-ninth Street and Broadway, New York City, the United Electric Light & Power Company has issued to its customers and friends white-metal pocket pieces of approximately the size of a half dollar, and good for 50 cents on any appliance purchase at any of the company's electric-appliance salesrooms. Only one pocket piece is acceptable on each purchase, but the offer continues until Oct. 1, of this year. The United company has also offered to send these pocket pieces to applicants on request, and has announced this offer on its monthly fliers advertising its fan and appliance sales.

Against Grounding of Bathroom Fixtures

Omaha (Neb.) Electrical Inspector Points Out Objections to Ordinance in Force in That City, After Experience Extending Over Eight Years

A wiring ordinance passed on March 10, 1908, by the Omaha (Neb.) City Council contained the following clause:

"Section 6. All sockets must be constructed of porcelain or other insulating material when installed over tile, cement or earthen floors, or when situated close to sinks, lavatories, bathtubs or radiators, or when located in other places where it is possible for a person in operating a socket to form an electrical circuit through his or her body. And when sockets installed in such locations are attached to fixtures, said fixtures must be effectively grounded and be wired with conductors having an approved insulating covering equal to that required for conduit construction."

In speaking of the results produced by wiring and fixtures installed under the terms of the foregoing clause, F. P. McGough, electrical inspector for the city, said:

"Our present grounding ordinance, while affording a certain measure of protection, has proved unsatisfactory on account of the difficulty of obtaining a permanent and effective ground connection due to the following causes: First, the difficulty of securing a perfect connection between the fixture shell and the ground wire; second, the liability of the ground wire being disconnected or broken; third, the prevalence of high resistance joints in the gas piping or conduit systems, and, fourth, the liability of the ground connections being broken through the removal of sections of pipe to which the conduit or ground wire is bonded or connected.

REMOTE-CONTROL SUGGESTED AS SUBSTITUTE FOR GROUNDING

"We have, therefore, become convinced that attempts to render the operation of such fixtures safe will not prove wholly reliable so long as they are dependent on conditions exterior to the fixture itself. We are therefore inclined to the opinion that the purpose of our ordinances can be accomplished with greater certainty in two ways: First, by requiring that the fixture be placed out of reach and controlled by a switch located at a safe distance from grounded metal work; or, second, by requiring that the socket and outer shell of the fixture be constructed of porcelain or other insulating material, thereby rendering the person touching it immune from all possible danger.

"Objection might be raised to fixtures having a non-metallic outer casing in instances where special finishes or designs are desirable. However, it seems reasonable to presume that such finishes or designs could be closely approximated in the event the porcelain manufacturers were called upon to supply fixtures such as I have described.

"We were induced to adopt our existing ordinance by reason of a number of fatalities, which convinced us that some remedial measure for the prevention of such accidents was an imperative necessity.

"Owing to the high resistance which is frequently encountered on pipe-driven ground connections, we did not consider the grounding of the neutral wire as ordinarily effected a sufficient measure of protection against the entrance of dangerously high voltages on the house-lighting system. We were further convinced that under certain conditions a pressure of 110 volts is sufficient to cause death."

How a Texas Company Has Installed an Electric Range Instructress in Every Town

Collaborating with one of the large manufacturing companies, the Texas Power & Light Company has appointed local electric cooking instructresses in the various towns served by its lines, where electric ranges are in use. The position is offered to some housewife who has a range of her own. The instructress is paid $2 for every trial customer she can secure on a thirty-day free trial offer and she receives $2 more for making three calls of instruction upon the customer. If the range is sold she receives a further commission of $5 on the sale, making a possible earning of $9 for each sale of a range.

The plan has already been in use for some time, and has been giving good results in those communities where it has been tried out thus far.

Advertising the Electric Range in the Highways

When a contractor's construction office was erected across the sidewalk directly adjoining the main office of the Minneapolis General Electric Company, H. M. Young, sales manager of the company, saw in the bare walls of the temporary obstruction a potential signboard to stimulate public interest in the electric range campaign which the company has under way. At an expense of $10 the signs herewith pictured were painted on the little building.

At a conservative estimate 10,000 people a day pass this sign display, and are forced by it to step from the sidewalk to the street, so that the legend receives its share of attention from pedestrians as well as from persons in automobiles and street cars. Mr. Young feels that it would have been practically impossible to buy the publicity which this sign achieves, and declares that it has been one of the important links in the chain of publicity through which the company has to date installed more than 100 electric ranges.

A CONSTRUCTION SHANTY THAT BECAME A USEFUL PUBLICITY FACTOR IN THE ELECTRIC-RANGE CAMPAIGN IN MINNEAPOLIS

LUMINOUS-ARC EQUIPMENT IN LIGHTING-IMPROVEMENT DISTRICT NO. 1, SALT LAKE CITY

Ornamental Lighting in Salt Lake City Under the New Lighting-Improvement-District Law

BY B. W. MENDENHALL

Special ornamental lighting service has just been established in Salt Lake City throughout lighting improvement district No. 1, the first district to be lighted under the new law. This new law was passed by the Utah Legislature of 1915, and provides for the creation of lighting improvement districts in cities and the installation of special lighting systems therein, the costs being assessed against the property owner according to the benefits derived. The new district embraces sixteen city blocks, and provides for the special lighting of approximately 2½ miles of street by 218 4-amp. pendant-type, luminous arc lamps. The district comprises practically all of the business section of the city, except Main Street, which is included in lighting district No. 2, for which a more elaborate system will be provided.

SALT LAKE CITY EQUIPMENT

In district No. 1 the 4-amp. luminous arc lamps are supported by ornamental brackets on each trolley pole on the street. The trolley poles are approximately 100-ft. apart, and the street between curb lines measures approximately 100 ft. in width, so that lamps are located at the corners of each 100-ft. square. This is equivalent to ninety-three lamps or 30 kw. per mile of street lighted.

The law under which this installation was made appears to be very satisfactory in that it provides a method of handling the special street lighting problem; that is, the lighting in excess of what the municipality regularly supplies. The statute referred to overcomes objections which have stood in the way of the success of most street-lighting schemes on a voluntary assessment basis. It enables the progressive property owners in the given business district to obtain a necessary public improvement in the same manner that they secured sidewalks and gutter paving and similar public improvements in the past. It puts the burden of maintaining this improvement where it belongs, viz., on the property owner, the value of whose property has been increased by the improvement and who is able to obtain a greater return in the way of rent from tenants. It eliminates that troublesome feature of changing tenancy, for under most voluntary plans the tenant has paid for the special street lighting. In case he moves or goes out of business he cannot be held for the payments, and the new tenant, not being influenced by the enthusiasm as was the original one, may or may not be willing to continue to pay the assessments.

OTHER ADVANTAGES OF NEW LIGHTING DISTRICT ACT

The law does away with the difficulty of obtaining support from absent landlords in case the special lighting were paid for by the property owner. Under the present law, while no definite percentage of the property owners need petition in order to inaugurate a movement for a lighting improvement district, it has not been difficult to obtain the signatures of the owners for a majority of the frontage, because these owners realize that the burden of support would be shared by all. Under the former voluntary schemes, however, many property owners refused to sign, knowing that many of the absent landlords could not be brought into the plan. Under the new law more than 50 per cent of the property frontage must protest against the improvement in order to defeat it. The expense for collection is reduced to a minimum, as the city does it along with other regular and special taxes levied, at a nominal cost.

Unlimited Vacuum-Cleaner Inspection Service Proves Good Sales Point

W. L. Fowler of the Fowler Electric Company, has for the last year been selling vacuum cleaners to the citizens of Cedar Rapids, Ia., with a written guarantee of unlimited inspection and repair service. He has salesmen out canvassing the town to sell other electrical devices besides the cleaners, paying a commission of half the margin above cost. These salesmen make regular periodic inspection of the cleaners, which are sold on time, or with 5 per cent discount for cash. "How do you get out from under the expense of maintaining this service?" a number of contractors asked Mr. Fowler at the recent Iowa Electrical Contractors' Association meeting in Dubuque, and he answered, "Do you suppose a salesman can call on a customer regularly and get acquainted with her and not sell her other electrical appliances?" He declared that this plan has proved to be a paying one, and has gained good advertising for the Fowler Electric Company's general business.

Hartford Company Wires 1550 Houses in Thirty Days

The Hartford (Conn.) Electric Light Company has just completed a campaign for the wiring of old houses. The campaign lasted only one month but during that period, according to G. H. Allen, manager of the contract department of the company, 1550 customers were secured for central station service.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Magnetic Properties of Vacuum-Fused Steel

The Effect of Melting in Vacuo Upon the Magnetic Properties of Pure Open-Hearth Iron—Increase of Permeability with Diminished Hysteresis

IN the issue of Dec. 11, 1915 (Vol. 66, page 1325), an account was given of some remarkable results obtained by Prof. Trygve D. Yensen of the University of Illinois on the magnetic properties of electrolytically refined iron and iron-cobalt alloys. Attention was called then to the improvement in the magnetic properties obtained by simply remelting electrolytic iron in vacuo. It seemed natural to assume that this improvement is due to the removal of gases from the iron, and a further question arose from these results as to the effect which remelting in vacuo would have upon commercial grades

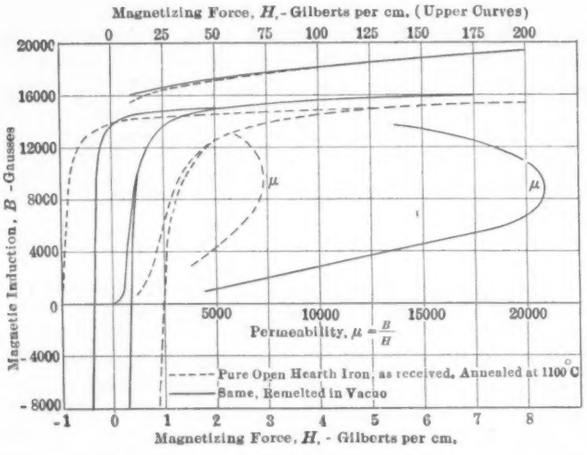


FIG. 1—RESULTS OF TESTS ON OPEN HEARTH AND VACUUM-FUSED STEELS

of iron (not electrolytically refined). The results of this new investigation are given in *Metallurgical and Chemical Engineering* of May 15, 1916. In taking up this problem Professor Yensen selected one of the purest grades of commercial iron obtainable. This was made by the open-hearth process and was 99.84 per cent pure Fe, sulphur being 0.025 per cent, phosphorus 0.005, carbon 0.010, manganese 0.025, silicon 0.005, copper 0.050, oxygen 0.035, nitrogen 0.004, and hydrogen 0.001. Test pieces were prepared from this iron as it was received from the manufacturer, and others were prepared from the iron after being remelted in vacuo. The test pieces consisted of rods, 1 cm. by 36 cm., used in connection with Burrows' compensated double bar and yoke method, and of rings 4.2 cm. outside diameter by 3.8 cm. inside diameter, tested by the ordinary ballistic method. These test pieces before the final testing were annealed at 1100 deg. C. in vacuo and cooled at the rate of 30 deg. C. per hour to room temperature.

The results obtained are given in Fig. 1. It is seen that the vacuum treatment has increased the maximum permeability from two to three times and decreased the hysteresis loss by a corresponding amount. The results show that nearly as good results are obtainable using pure open-hearth iron as a base as with the pure electrolytic iron. As far as the chemical analysis is concerned it is difficult to point out any material difference between the open-hearth iron before and after the vacuum treatment. Only as far as the CO and CO_2 gases are concerned it may be stated that there has been a material reduction by the vacuum treatment.

In order to obtain further information regarding possible differences, samples were examined for density and under the microscope. The density tests showed very slight differences between the treated and untreated iron, but out of a number of tests under different conditions and by different persons the density of the vacuum-treated iron was in every case found to be higher, the average difference being about 0.1 per cent.

The results thus far obtained seem to indicate that the more pure the iron the larger are the crystals. Previous results also point toward a possible connection between high magnetic permeability and large crystals, when comparing irons of the same general composition having received the same mechanical and heat treatment. It may be a question, however, whether magnetic permeability has anything to do with the crystal size, as it may depend solely upon the purity of the iron. In favor of this contention may be cited the fact that when pure iron has been annealed at temperatures above 900 deg. C., followed by slow cooling, the resulting crystals are much smaller than after annealing at or below 900 deg., and yet the magnetic permeability is generally increased by annealing at the higher temperatures.

From these facts and indications the only safe conclusion that may be drawn is that the open-hearth iron has been purified by the vacuum treatment to a degree not obtainable by any ordinary process of manufacture, and, furthermore, that this purification has resulted in marked improvements in the magnetic properties. Together with the results previously obtained with Swedish charcoal iron, these results show definitely that it is possible to obtain magnetic properties with commercial grades of iron by vacuum fusion that are comparable with those obtainable with electrolytic iron.

Generators, Motors and Transformers

Ball Bearings for Electric Motors.—An illustrated article discussing the reduction of first cost of motors due to the use of ball bearings, the design of different systems of ball bearings, the importance of ball contact, alignment, fittings, lubrication, and applications.—London *Elec. Review*, March 31, 1916.

Converter.—C. F. HOLMBOE.—A translation in abstract of his German article on tests of a 3000-kw. converter, changing three-phase current at 5000 volts into direct current of 6000 amp. at 500 volts for an electrolytic plant.—London *Electrician*, April 28, 1916.

Load Equalization.—A note on a recent British patent (5200, 1915) of the British Thomson-Houston Company, N. Shuttleworth and G. M. Brown, for control of flywheel motor-generators driven by induction motors by automatic regulation of a series-type commutator

machine connected in cascade with the induction motor, so that the excitation of the commutator machine is comparatively weak between no load and the predetermined load, and thereafter increases rapidly with further additions of load. This regulation is obtained by diverting current from the series exciting windings through a variable reactance adapted to increase in value automatically by a variable air gap or otherwise, and diverting less current the higher the load.—London *Elec. Eng'ing*, May 4, 1916.

Wires, Wiring and Conduits

Pyroelectric Conductors.—CHARLES PROTEUS STEINMETZ.—In an article on electric conductors, the author distinguishes between metallic, electrolytic and pyroelectric conductors and gives characteristic resistance-temperature and volt-ampere diagrams for these three classes. The metallic conductors, as do the electrolytic conductors, give a volt-ampere characteristic in which, with increase of current, the voltage rises faster than the current in the metallic conductors, due to their positive temperature coefficient, and slower than the current in the electrolytes, due to their negative temperature coefficient. The characteristic of the pyroelectric conductors, however, has such a very high negative temperature coefficient of resistance; that is, such rapid decrease of resistance with increase of temperature, that over a wide range of current the voltage decreases with increase of current. Their volt-ampere characteristic, therefore, has a shape as shown diagrammatically in Fig. 2, though not all such conductors will show the complete curve. In range 1 the conduction is purely metallic; in range 4 it becomes purely electrolytic and is usually accompanied by chemical action. Range 1 and point *a* are often absent, and the conduction begins with a slight negative temperature coefficient. The complete curve, Fig. 2, can be observed only in few substances, such as magnetite. Minimum voltage point *c* and range 4 are often unattainable, owing to melting of the conductor material or to its being otherwise destroyed by heat before this point is reached. This, for instance, is the case with cast silicon. The maximum voltage point *b* is often unattainable, and the passage from range 2 to range 3 by increasing the current is therefore not feasible, because the maximum voltage point *b* is so high that disruptive discharge occurs before it is reached. Such, for instance, is the case with glass, the Nernst lamp conductor, etc. Intimate mixtures of conductors, such as graphite, coke, powdered metal, etc., with non-conductors, such as clay, carborundum and cement, also have pyroelectric conduction. They are used for such purposes as resistance rods in lightning arresters, and in some rheostats. Many, if not all, so-called insulators, probably are in reality pyroelectric conductors, in which the maximum voltage point *b* is so high that the range 3 of decreasing characteristic can be reached only by the application of external heat, as in the Nernst lamp conductor, or cannot be reached at all because of chemical dissociation beginning below its temperature, as in organic insulators. Pyroelectric conductors as structural elements of an electric circuit show some very interesting effects, which may be illustrated on the magnetite rod, Fig. 3. The maximum terminal voltage which can exist across this rod in stationary conditions is 25 volts at 1 amp. With increasing terminal voltage the current gradually increases, until 25 volts is reached and then without further increase of impressed voltage the current rapidly rises to short-circuit values. Thus such resistance can be used as excess voltage cut-out, or, when connected between circuit and ground, as an excess voltage grounding device. Below 24 volts it by-passes a negligible current only, but if the voltage rises above 25 volts it short-circuits the voltage and therefore stops further rise, or operates the circuit breaker or some such device. As the decrease of resistance is the result of temperature rise, it is not instantaneous, and thus the rod does not react on transient voltage rises, but only on lasting ones. Within a considerable voltage range—between 16.5 and 25 volts—three values of current exist for the same terminal voltage. Thus at 20 volts between the terminals of the rod the current may be 0.02 amp., or 4.1 amp., or 36 amp. That is, if placed in series in a constant-current circuit of 4.1 amp., this rod would show the same terminal voltage as in a 0.02-amp, or a 36-amp. constant-current circuit, viz., 20 volts. On constant-potential supply, however, only the ranges 1, 2 and 4 are stable, the range 3 being unstable. Here we have a conductor that is unstable in a certain range of currents, from point *b* at 1 amp. to point *c* at 20 amp. With 20 volts impressed upon the rod, 0.02 amp. may pass through it, and the conditions are stable. That is, a tendency to increase of current would check itself by requiring an increase of voltage beyond that supplied, and a decrease of current would reduce the voltage consumption below that employed, and thus be checked. At the same impressed voltage, 36 amp. may pass through rod, or 1800 times as much as before, and the conditions again are stable. A current of 4.1 amp. also would consume a terminal voltage of 20, but the condition now is unstable. If the current increased ever so little, from a momentary voltage rise, then the voltage consumed by the rod decreases—becomes less than the ter-

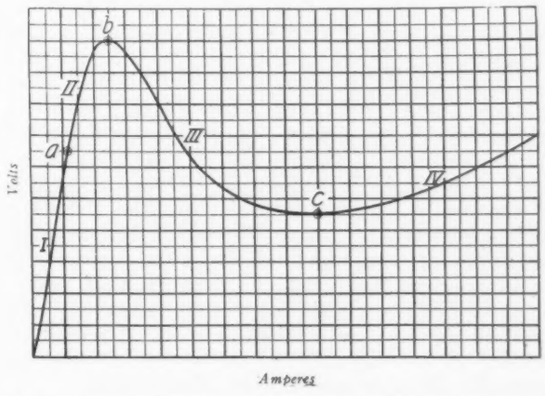


FIG. 2—CHARACTERISTIC OF PYROELECTRIC CONDUCTORS

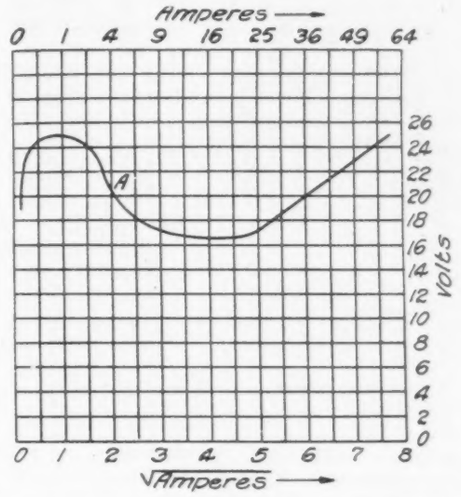


FIG. 3—VOLT-AMPERE CHARACTERISTIC OF MAGNETITE ROD

minal voltage of 200—and the current thus increases proportionally as the supply voltage exceeds the consumed voltage. This, however, still further decreases the consumed voltage, thereby increasing the current, which rapidly rises until conditions become stable at 36 amp. Inversely, a momentary decrease of the current below 4.1 amp. increases the voltage required by the rod, and, not being available at constant supply voltage of current, this higher voltage decreases. This, however, still further increases the required voltage and decreases the current, until conditions become stable at 0.02 amp. It is possible that pyroelectric conductors should be divided into two classes: First, true pyroelectric conductors, in which the very high negative temperature coefficient is a characteristic of the material. In this class probably belong silicon and its alloys, boron, magnetite and other metallic oxides, sulphides, carbides, etc.; second, conductors which are mixtures of materials of high conductivity and of non-conductors, and derive their resistance from the contact resistance between the conducting particles which are separated by non-conductors. As contact resistance shares with arc conduction the dropping volt-ampere characteristic, such mixtures thereby imitate pyroelectric conduction. In this class probably belong the graphite clay rods used industrially. Powders of metals, graphite and other good conductors also belong in this class.—*Gen. Elec. Rev.*, May, 1916.

Electrophysics and Magnetism

Rectifying Contact of Two Solid Conductors.—D. Owen.—A brief abstract of a (British) Physical Society paper on the laws of variation of resistance with voltage at a rectifying contact of two solid conductors, with application to the electric wave detector. It contains an account of an investigation, the primary object of which was to determine the nature of the physical actions occurring at a rectifying contact. Resistance characteristics are given for various contacts, some including a mineral, some in which both elements are metals. It is shown that a specific characteristic may be drawn for any given pair of materials. The experimental results are in accordance with the view that the actions are thermo-electric, the main determining factors being the thermo-electric power and the temperature coefficient of electric resistance. Based on the law of constancy of the voltage-coefficient calculations are given showing the best value of the resistance of the telephone in a wireless receiving circuit in which the contact detector is employed. The influence of a polarizing voltage is also traced. The use of the combination of rectifier with a direct-current galvanometer as indicator of the balance point in an alternating-current bridge is examined, and it is shown that the minimum detectable alternating voltage cannot be reduced much below a millivolt.—London *Electrician*, May 5, 1916.

Distribution of Current Between a Gas Column and a Metallic Shunt.—Robert F. Earhart.—An account of experiments which were made for the purpose of studying some of the conditions under which a current of electricity passing through a gas might be diverted through a metallic circuit. It was desired also to study the quantitative distribution between a gas column and a metallic circuit under several conditions. The chief results are as follows: The effectiveness of electrodes in taking current out of a conducting gas column depends more upon the state of division of the electrodes than upon their superficial area. The effect of offering an alternative path through an external metallic conductor is to decrease the total current. For small currents an increase through the shunt circuit occurs when the total current increases. Such increases are proportional to the total current, but the value of the factor depends on the pressure of the gas and form of the electrodes. The proportionality factor just referred to holds up to a limiting value which depends on the pressure employed. Further increase in total current results in a decrease in current through the shunt circuit.—*Phys. Rev.*, April, 1916.

Units, Measurements and Instruments

Temperature Scale.—Beginning with April 1, 1916, thermometers and pyrometers are calibrated by the German Reichsanstalt according to a newly-defined temperature scale which, according to the present status of thermometry, corresponds to the thermodynamic scale. The latter may change as the result of new scientific investigations. But the intention is not to change the newly-defined practical scale. For the definition of the scale of the platinum resistance thermometer the boiling points of carbon dioxide and oxygen, the melting points and solidification points of mercury, tin, cadmium, zinc, sulphur, antimony, silver, gold, copper, palladium and platinum are used and the transformation point of sodium sulphate and the boiling points of naphthalin and benzophenon. Between 0 deg. and 100 deg. C. the new scale agrees with the international hydrogen scale within the limits of error, while for very high temperature it agrees with the radiometric scale based on homogeneous black radiation but not with the gas thermometer.—*Zeit. f. Instrumentenkunde*, Vol. 36, page 20, abstracted in *Elek. Zeit.*, March 30, 1916.

Tests of Insulating Oils.—A long abstract of a report of a committee of the (British) Institution of Electrical Engineers. In order to judge the suitability of an oil for use as a cooling insulating medium it is necessary to know its characteristics in the following respects: Tendency to sludge, loss by evaporation, flash point, viscosity at different temperatures, chemical reactions, density and coefficient of expansion, cold test (solidification), moisture absorption, dielectric strength, specific resistance, thermal transference, specific heat. Suitable tests with respect to these different items are described and discussed.—London *Electrician*, April 21, 1916.

Alternating-Current Resistance of Iron Wire.—W. Peukert.—An illustrated translation in abstract of his German paper on the variation of the resistance of iron wires with the temperature on alternating-current circuits.—London *Electrician*, April 28, 1916.

Gold-Leaf Electroscope.—T. Barratt.—A brief abstract of a (British) Physical Society paper on the electrical capacity of gold-leaf electroscopes. A gold-leaf electroscope is frequently used to compare exceedingly small ionization currents. For this purpose it is much more sensitive than a quadrant electrometer. If the capacity of the electroscope is known, the absolute value in amperes of the ionization current can be deduced. A method for measuring the capacity of a gold-leaf electroscope depends on sharing the charge of a parallel-plate air condenser of measurable capacity as many times as necessary, and deducing the capacity of the electroscope from the observed drop of potential. The method gives consistent results when the experimental conditions are widely varied. The amount of deflection of the leaf appears to have little influence on the result.—London *Electrician*, May 5, 1916.

Roentgen Ray Apparatus.—A note on a recent British patent (9428, 1915) of the British Thomson-Houston Company and the General Electric Company of this country for Roentgen-ray tubes in which the surface subjected to the discharge is continually renewed by rotating the tube as a whole and magnetically deflecting the cathode beam out of the axis of rotation, while keeping the focal spot fixed in space.—London *Elec. Eng'ing*, April 13, 1916.

H. V. BOZELL

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Harold V. Bozell, professor of electrical engineering at the University of Oklahoma, Norman, Okla., and representative of the A. I. E. E. on the Oklahoma committee on industrial preparedness, has just been chosen chairman of the State board of preparedness directors. In addition to his educational work Professor Bozell conducts a consulting engineering practice, and for the last five years has been secretary-treasurer of the Oklahoma Electric Railway Association, of which he was one of the organizers. He has been active in several Oklahoma valuation and rate cases, and is the author of a book, "Data on Municipal Plant Operation in Oklahoma." Professor Bozell is a graduate of the University of Kansas, class of 1908. The electrical engineering course of the University of Oklahoma was barely started when he came to Norman, but has since grown until the enrollment of electrical students is now greater than the sum of those in the mechanical, civil, mining and chemical engineering departments.

Grant Armor, advertising manager of the *Electric Journal*, is recovering from a three-weeks' illness in a Pittsburgh hospital.

Chester P. Gross, who for some time has been connected with the Wisconsin Railroad Commission, has been appointed superintendent of the municipal electric-light plant at Grand Rapids, Wis.

C. T. Anderson, formerly with the Ohio Brass Company, has been appointed vice-president and sales manager of the Hartman Electrical Manufacturing Company of Mansfield, Ohio, manufacturers of rail bonds and electrical specialties.

W. G. Moore, until recently manager for the Texas Power & Light Company at Paris, Texas, has severed his connection with that company to enter into a partnership known as Collins & Moore, consulting electrical engineers and contractors of Paris.

E. H. Beam of Knoxville, Tenn., has been appointed department manager of the Niagara Light, Heat & Power Company of North Tonawanda, N. Y., to succeed C. G. Murdock, who has resigned to assume charge of electrical interests in St. Louis, Mo.

Percy S. Irving of Boston, Mass., will have charge of the new-business department of the Great Barrington (Mass.) Electric Light Company.

E. H. Beam has been appointed manager of the new-business department of the Niagara Light, Heat & Power Company of Tonawanda, N. Y., succeeding C. G. Murdock, who has accepted a position in St. Louis, Mo.

E. Z. Wallower, who for the last two years has been general manager of the Lockport (N. Y.) Light, Heat & Power Company, has resigned to assume active management of a group of oil and mineral properties in Missouri and Oklahoma. Mr. Wallower was at one time superintendent of the Harrisburg (Pa.) Light & Power Company.

J. H. Shearer, formerly in charge of the Eastern Shore Gas & Electric Company, with headquarters at Salisbury, Md., has been appointed general superintendent of the Penn Central Light & Power Company of Altoona, Pa., succeeding E. B. Green, who, as announced in these columns, has resigned after more than a quarter century of service.

D. O. Vaughn, formerly with the F. Bissell Company of Toledo, Ohio, has been appointed manager of the Sidney (Ohio) Electric Company, succeeding F. D. Elwell, who recently resigned to take up consulting engineering and construction work for the Albert Emanuel Company, owners of the Sidney Electric Company.

Edward B. Ellicott, who has tendered his resignation as chief electrical engineer of the Sanitary District of Chicago, becoming effective on May 25, has completed eleven years of service with the Sanitary District, and a total of nineteen years of public service work in Chicago. Mr. Ellicott is leaving Chicago to live during the summer months on his ranch in Idaho just southwest of Yellowstone Park. He will also open a consulting engineering office in Salt Lake City and will reside there in the winter. Mr. Ellicott was born at Lockport, N. Y., on March 28, 1866. From 1885 to 1887 he was employed by the Concordia (Kan.) Electric Light Company in plant construction, and later in general charge of operation. In 1887 and 1888 he was engineer and electrician of the Salina (Kan.) Gas & Electric Company. Returning to Concordia in 1888 he was superintendent and electrician of the electric station there for two years. From 1890 to 1897 he was employed by the Western Electric Company of Chicago installing steam and electric plants. During the year of 1891 he was placed in charge of the Urbana (Ohio) plant which was owned by the Western Electric Company, and in 1892 was promoted to the position of assistant superintendent of construction, later becoming superintendent of construction for the Western Electric Company, which position he held until 1897. From 1897 to 1905 Mr. Ellicott was electrical engineer for the city of Chicago. During that time he rebuilt the city's street lighting system which consisted of 1250 arc lamps and added 5000 arc lamps to the existing plant. During the year 1903 he secured a leave of absence from the city position to become chief mechanical and electrical engineer for the Louisiana Purchase Exposition at St. Louis, Mo., and while serving in that capacity he practically designed and superintended the construction of the entire steam and electrical equipment of the exposition. From 1905 to 1916 he served as electrical engineer for the Sanitary District of Chicago. In that capacity he designed and built the 32,000-kw. water-power and transmission system of the District and directed the work of completely rehabilitating the city's lighting system under a contract which required the installation of 21,000 lighting units. Mr. Ellicott is a fellow of the American Society of Electrical Engineers, and a member of the American Society of Mechanical Engineers, the Western Society of Engineers, and the National Municipal Electricians.

E. B. ELLICOTT

Obituary

George Carson Smith, actively identified with the Westinghouse interests for many years, and formerly financial adviser to George Westinghouse, died at New York May 30 at the age of sixty-two years. Mr. Smith had held many important railroad executive posts, and at the time of his death was a director in nearly all of the Westinghouse companies.

William P. Harper, for fifteen years head of the purchasing department of the Allis-Chalmers Company, Milwaukee, Wis., and president of the Northwestern Manufacturing Company of Milwaukee since 1904, died of apoplexy at his home, May 27, at the age of 52 years. Mr. Harper was well known among electrical men of the Middle West.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

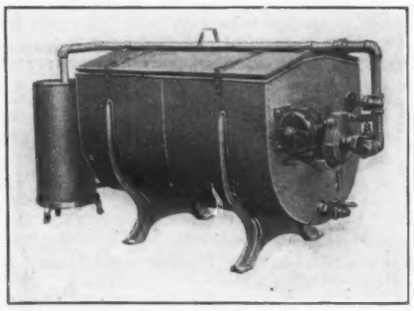
Motor-Driven Pasteurizer

The main object of pasteurization is to eliminate disease by destroying bacteria or germ life in the milk. Milk from healthy cows, if properly handled, is said to be free from disease germs, but exposure to air and unhealthy conditions cause germs to accumulate and propagate in vast numbers. These germs can be eliminated by pasteurization.

Physicians and scientific men claim that the use of pasteurized milk has saved the lives of a multitude of children as well as adults, and they consider it health-giving to a very decided extent, since the process of pasteurization, it is claimed, does not detract from the well-known nutritive value of milk.

The commercial advantages of pasteurization are many. The body of the milk, as well as the keeping quality, is materially improved, it is asserted, and the butter made from pasteurized milk retains its flavor when bottled and will always show a good cream line.

The widespread demand for pasteurized milk and cream has caused the A. H. Reid Creamery & Dairy Supply Company of Philadelphia, Pa., to develop a line of pasteurizers, using what is known as the "Batch" pasteurizing system. The machine consists essentially of a cylindrical vat and a spiral coil of heavy copper tubing. The coil is arranged so that it can be revolved, the ends terminating in gland-type stuffing boxes. The water is heated in a separate tank, connected to either end of the coil by piping. The water is circulated from the heater through the coil and back to the heater. The practice is to heat the milk to 140 deg. Fahr. or 145 deg. Fahr. and hold this temperature for thirty minutes. Then cold water is introduced into the coil and the milk cooled down to bottling temperature, which is about 50 deg. Fahr.



PASTEURIZER DRIVEN BY 0.75-HP. MOTOR

or less. The illustration shows a Reid positive pasteurizer equipped with a 0.75-hp. single-phase induction motor manufactured by the Westinghouse Electric Manufacturing Company of East Pittsburgh, Pa. The motor is directly connected to the worm drive of the spiral coil and gives the constant speed necessary for pasteurization work.

Direct-Current Bell Ringer

In the accompanying illustration is shown a bell ringer placed on the market by the Terminal Electric Company, 551 West Forty-second Street, New York, which is designed to convert direct current at pressures of 110 volts or more to direct current at potentials of from 6 volts to 35 volts. It is also adapted for use with annunciators, interior telephones, electric clocks and time stamps, thermostats, spark ignition coils, cauterizers, miniature lamps, toys, etc. The principle on which the operation of the device is based is that

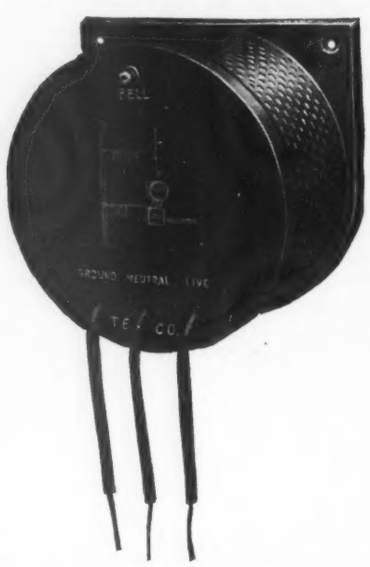


FIG. 1—BELL RINGER FOR DIRECT-CURRENT CIRCUITS

of a potentiometer. In one type a resistor is connected across the line and a tap made to this resistor, at a point which gives a potential of 6 volts to 35 volts, measured to ground. In this form of the device, the resistor consumes 0.6 amp. continuously. In another type, two resistors and a relay are employed. The latter type has a normal current consumption on the primary side of 30 mil-amp. The secondary circuit is provided with a relay; when the circuit is closed a low resistance coil on the primary side is placed in circuit and the total current consumption on the secondary side is then 1.5 amp. These bell ringers are built in sizes with ratings of from 5 watts to 200 watts. The Type A device is rated at 5 watts and is designed for a primary pressure of 120 volts and a secondary pressure of 35 volts.

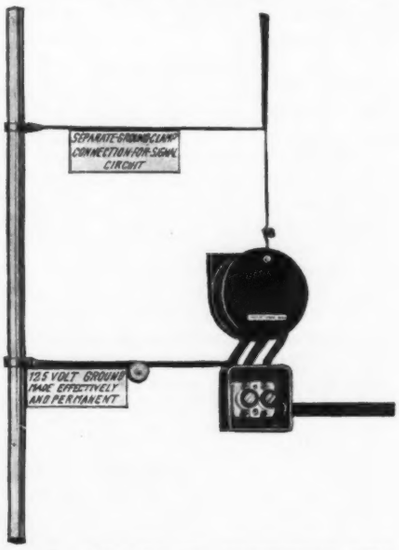


FIG. 2.—METHOD OF CONNECTING BELL RINGER

It weighs 4 lb. and is designed to operate two 3-in. bells simultaneously. The Type C bell ringers are rated at from 20 watts to 200 watts. The primary voltage of these ringers is 120 volts and the secondary pressure 18 volts for the 60-watt, 100-watt and 200-watt devices and 24 volts for the 20-watt bell ringer. The respective weights of these devices are 6 lb., 10 lb., 15 lb. and 30 lb. Another device designated by the manufacturer as the Type BC device operates two independent circuits, such as closed and open, etc., for fire-alarm, burglar-alarm, and self-winding clock systems, and is being built with ratings of from 2 watts to 200 watts. A Type RT device designed for interior telephones, talking or ringing, or both, is being built with ratings of from 4 watts to 25 watts.

A New Transformer Oil

"Lectroseal" (L. S.) oil is a new grade of insulating transformer oil recently placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This oil has its chief application as an insulating and cooling medium for use with all classes of oil-insulated distributing and power transformers. It may also be used with such apparatus as induction-type-feeder regulators and electrolytic lightning arresters.

Lectroseal is a pure mineral oil, ob-

tained by the fractional distillation of petroleum and is free from moisture, acid, alkali and sulphur compounds. As an insulating medium, it has a high dielectric strength. The average breakdown test is said to be 40,000 volts on a 0.15-in. gap between spheres 0.5 in. in diameter. As a cooling medium, it is claimed that the oil is particularly well adapted, the viscosity being very low (approximately 36 at 40 deg. C., Saybolt method). Consequently, the oil will circulate rapidly and transfer the heat quickly from the transformer or other apparatus to the walls of the tank.

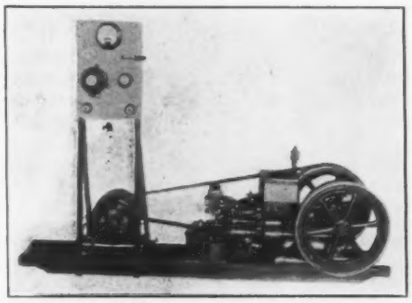
If water should accidentally enter a transformer tank, it should sink to the bottom of the tank as quickly as possible, as a small percentage of water thoroughly mixed with the oil reduces its dielectric strength very rapidly. Various grades of oil differ greatly as to their ability to separate from water with which they have been mechanically mixed, but lectroseal oil, it is claimed, possesses this quality in a marked degree. The other characteristics claimed for the oil, such as freedom from deposit, satisfactory flash and fire point, low rate of evaporation and light color, would indicate that it is practically ideal for the purpose for which it is intended.

Electric Dictating Machine Installed in Magnetic Car

Arthur Brisbane, the famous newspaper man, has devised a cushioned box for use with an Edison dictating machine installed in his Owen magnetic car (described in the ELECTRICAL WORLD of Jan. 8, 1916), and he is shown in the accompanying illustrations seated in his automobile with Thomas Edison, the inventor of the dictating machine, and R. M. Owen, who has developed the magnetic or electric-transmission car. Mr. Brisbane travels back and forth daily from his home in Hempstead, Long Island, to his office in New York in the car illustrated, and with the dictating machine is enabled to add two hours to his working day—two working hours in the fresh air, as he expressed it. The Owen car with its electric transmission has been found particularly well adapted for use with a dictating machine because of its smooth-operating features. Mr. Brisbane suggests that a dictating machine installed in an automobile as shown should be of especial interest to business men who travel in their cars to and from their offices. "To work in a car with the window open," he declares, "fresh air pouring in, no interruptions from telephones, or callers, is indeed a luxury, and productive luxury, which is the only good luxury." Messrs. Brisbane and Owen are shown herewith shortly after arriving at Mr. Edison's laboratory in Orange, N. J. In Fig. 2 Mr. Edison is shown talking into the dictating machine.

Small Generating Outfit

The Type NS lighting plant shown herewith is, according to the maker, the Friday Machinery & Supply Company, Sigourney, Iowa, of simple construction, no complicated wiring systems being utilized and all unnecessary parts being eliminated. In the illustration the battery is not shown. The battery is of the sealed-glass-jar type; the rubber-jar type, however, may be provided, if desired. Batteries with ratings of 40 amp.-hr., 60 amp.-hr., 80 amp.-hr., and 100 amp.-hr., are being furnished with the plant, which may be operated by gasoline, kerosene, or crude-oil engines with ratings of from 2 hp. up. The company is also making large-sized plants for use on large farms and in motion picture theaters and for operating small-town lighting systems. It has also developed special battery-charging equipments for garages.



GASOLINE-ENGINE-DRIVEN GENERATING PLANT

Mercury-Vapor Lamps for Electric Blueprinting

The first Cooper Hewitt lamps used in electric blueprinting were placed in front of a flat frame with reflectors behind the lamps, which only allowed prints as large as the frame to be made at one time. This limited the size of the tracing that could be accommodated and made it necessary to reload the machine for each exposure. Lamps with flat frames are frequently satisfactory where the requirements are small, but where blueprints are large the continuous machines are better.

The Revolute Machine Company of 417 East Ninety-third Street, New York City, based the design of its Everett-McAdam type of blueprint machine upon a revolving glass cylinder, the light being within the cylinder and the rays striking practically perpendicular to the service of the blueprint paper which is wrapped around the cylinder. By this scheme, 75 per cent of all the light is direct, 25 per cent reflected and none entirely lost. This makes the machine highly efficient and rapid and allows the production of a print of any length whatever.

The paper is laid over the revolving glass cylinder, where it remains during three-quarters of a revolution, after which it leaves the cylinder and is caught in a suitable receptacle. The tracings are fed in between the paper and the cylinder so that the light strikes through the cylinder and the tracing on the blueprint paper. Continuous rolls of any length may be fed through the machine with either long tracings or those of smaller sizes, so that an extra standard roll of 50 yd. may be printed in one piece.

Special high-power lamps, made for this particular service by the Cooper Hewitt Electric Company of Hoboken, N. J., allow the machine to print at a

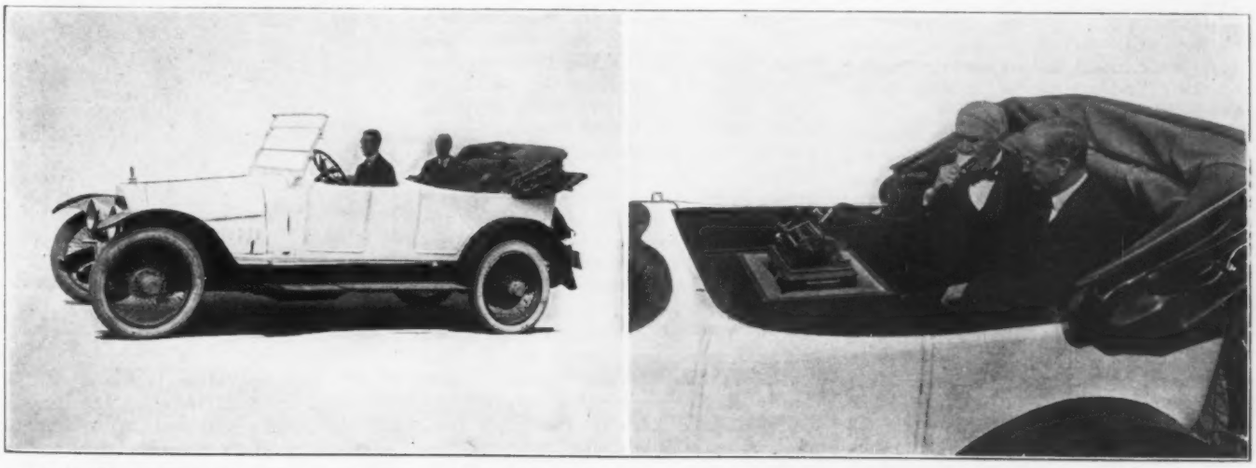
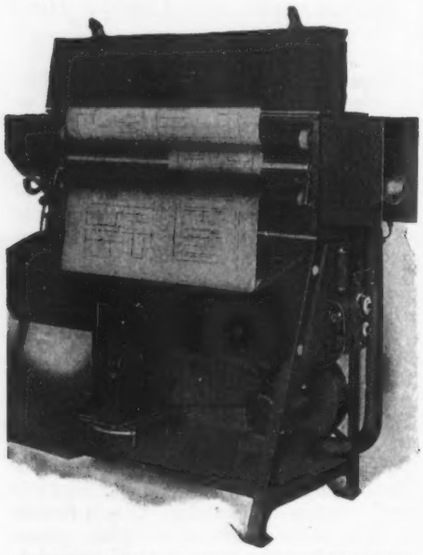


FIG. 1—MESSRS. EDISON. OWEN AND BRISBANE (RIGHT TO LEFT) IN ELECTRIC TRANSMISSION CAR

FIG. 2—MR. EDISON TALKING INTO DICTATING MACHINE—MR. BRISBANE AT HIS SIDE

high rate of speed on comparatively small energy consumption. This speed efficiency is due partly to the design of the machine, the lights being within the cylinder, and partly to the quality of the light from the mercury-vapor lamps, which is very well adapted to blueprint work.



BLUE-PRINTING MACHINE EQUIPPED WITH MERCURY-VAPOR LAMPS

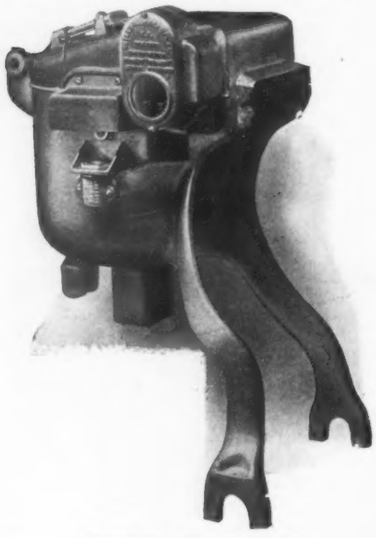
Arc lamps may also be used on this sort of machine. In the case of this type of lamp, which must be hung outside the cylinder, the light passes through the cylinder to the paper on the opposite side from the lamps, and the printing is done during half a revolution. Where mercury lamps are used inside the cylinder, the light passes through one thickness of glass, and the printing is done during three-quarters of a revolution. The mercury-vapor lamps are automatic and start by the turn of a switch, and, in contrast to arc lamps, require no attention whatever during their life, which is guaranteed to be 1200 hr.

The machine, which is electrically driven, is equipped with a variable-speed gear, which allows it to be run at a speed necessary to suit the requirements of different kinds of paper and different tracings or negatives to be printed. Due to the small curvature of the cylinder and a series of endless belts which hold the paper and tracing on the cylinder, a perfect contact is obtained at all points.

The revolving glass cylinder entirely eliminates the necessity of dragging the tracings and paper over a curved stationary glass, avoids the possibility of slipping, saves wear and tear on the tracings, and gives a sharp detail to the prints.

Electrically Heated Linotype Metal Pots

A comparatively new application of electric heating is that of keeping in a molten condition the metal in the pots of linotype machines from which the slugs bearing the characters are cast. The printer finds the electrical method free from the disadvantages of gas and gasoline heating, and the slugs produced are practically perfect owing to the close and accurate regulation of temperature. The electric linotype pot shown herewith is being made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., and is sold exclusively by the Mergenthaler Linotype Company, New York. Each unit consists of a series of resistor ribbons of metal alloy incased first in mica, then in metal ducts, and sealed by autogenous welding inside of a steel casing. Since the ducts are welded to the casing perfect conductivity of heat is obtained, it is asserted. The two main units are immersed directly in the metal in the pot, while two more are disposed about the throat and mouthpiece of the pot to insure proper temperature at these points. The circuit is initially closed by an ordinary snap switch. Thereafter the circuit is automatically controlled by a special thermometer, set to maintain the temperature desired, which limits the range within 10 deg. either



ELECTRIC LINOTYPE POT

way from the predetermined point. This special thermometer consists of an air-tight metal tube filled with mercury, the enlarged end of which rests in the pot. The other end of the tube is formed into a spiral and attached to a lever. As the temperature rises and falls the mercury in the tube expands and contracts, causing the spiral to open and close and the lever to move back and forth between two contact points. This makes and breaks a relay circuit, in turn controlling the current in the heating elements. In first heating the pot from a cold condition the input is 1600 watts, and is maintained for about fifty minutes. When the proper temperature point is reached the thermometer cuts it down to the operating rate of 550 watts. As there are said to be more than 20,000 linotype machines in the United States (many of them operating twenty-four hours a day) and as the peak load comes from midnight until morning, the electric linotype pot, it is pointed out, makes a very attractive addition to central station lines.

Boiler Meter

In the accompanying illustration is shown a boiler meter, which, according to the manufacturer, the Bailey Meter Company, 141 Milk Street, Boston, Mass., is a radically new instrument designed to fill a long-felt want in boiler-plant operation. It is a combination of three separate meters in one casing, each drawing its own record in a distinctive color on a 12-in. chart, and records (1) the rate of steam output from the boiler; (2) the rate of air flow through the furnace, and (3) the condition of the fuel bed. It not only records these operations, but also correlates and compares them in such a simple manner, it is pointed out, that any fireman can readily understand the readings and be informed instantly of any needed change in the furnace or draft conditions to secure the best efficiency and maximum capacity.

The steam flow is recorded by the "red" pen, drawing a red record in the center section of the chart, the graduations being in per cent of the boiler's rated capacity on a uniform scale. This part of the meter is identical with the Bailey steam meter described in the ELECTRICAL WORLD of April 15, 1916. It operates upon the principle of measuring the pressure difference across a monel-metal orifice placed in a flange of the steam line. The air flow is recorded by the "blue" pen drawing a blue record. This pen is located so that it travels immediately in front of and records just ahead of the steam-flow

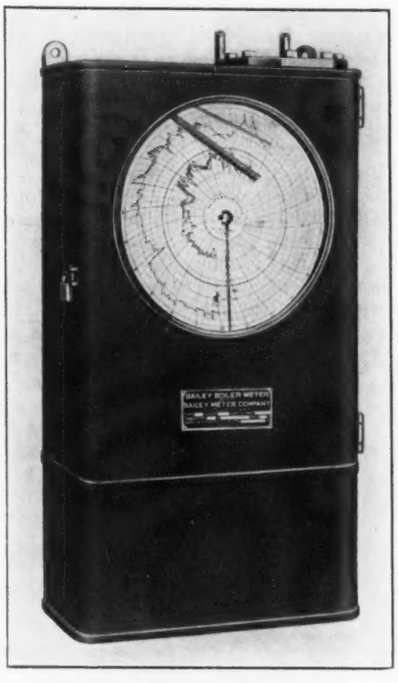


FIG. 1.—BOILER METER WHICH MAKES THREE RECORDS

record. Its operation is based on the difference in draft between the firebox and the uptake, but instead of reading in terms of draft it reads in terms of steam output. In other words it gives the same reading and draws a coincident record with the steam flow so

long as the right amount of air is used for combustion. If the air flow reads more than the steam flow it shows too much air and corresponds to low CO_2, if it reads less than the steam flow it means insufficient air and loss due to unburned gases. This is based upon

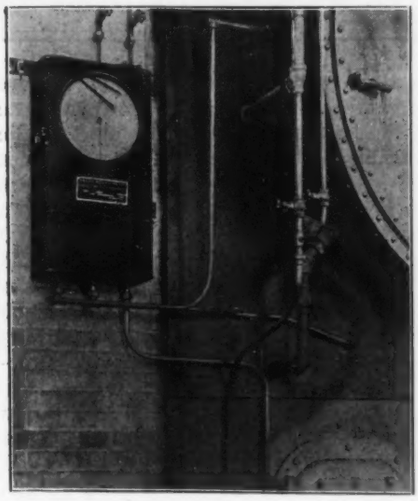


FIG. 2.—METER INSTALLED ON A RETURN-TUBULAR-BOILER

the principle that air is a fuel just as much as coal is, and a certain evaporation should be obtained per pound of air. This standard is determined for each boiler and the meter adjusted accordingly.

The furnace indicator drawing a record on the outer section of the chart shows the conditions of the fuel bed. The fire is of the right thickness when this pen is on the shaded band, too thick when above and too thin when below the band. This also is adjusted

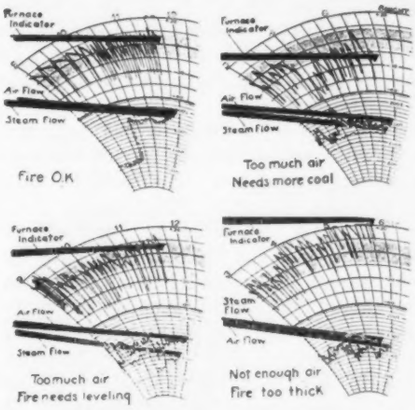


FIG. 3—DIAGRAMS SHOWING VARYING CONDITIONS OF FIRE

to individual conditions after extensive tests have been made to determine the best kind of fire to carry. This furnace indicator is operated by draft pressures and is in reality a measure of the resistance of the fuel bed to the flow of air. It should not be confused with the drop in draft pressure across the fuel bed, for it includes the draft pressure in the uptake as well as the firebox and ashpit in such a way as to eliminate the effect due to the intensity of the draft or the rate of flow of air and responds only to changes in condition of the fuel bed. That is, the pen does not move when the damper opening or draft pressure varies from maximum to minimum unless the fire changes, but when the fire burns too thin or develops holes, the recorder shows it regardless of the intensity of the draft.

Every part of the meter responds instantly to changes in any of the operating conditions, it is claimed. In a hand-fired furnace it plainly shows each opening of the fire door, cleaning of the fire, etc. When applied to stokers it brings out many very interesting points regarding the operation and control. To say that one meter does all of these things might lead one to believe that the instrument is a complicated and elaborate device unsuited to boiler room conditions, the manufacturer points out, but a careful inspection of its working parts shows it to be of very simple design.

Automatic Lighting and Ignition Switches

The usual method of protecting the automobile battery against grounds or short-circuits is to install a fuse on each circuit. The blowing of the fuse, however, occasions considerable annoy-

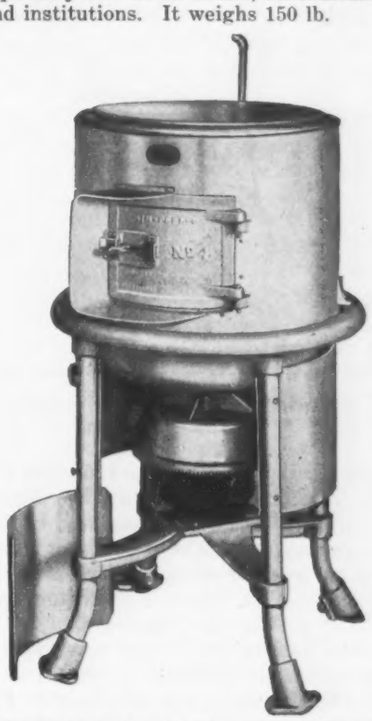
IGNITION AND LIGHTING SWITCH

ance and inconvenience to the motorist. Generally the fuses blow as a result of a momentary accidental ground occurring while some repair or adjustment is made to the electrical equipment. It is then necessary to locate the blown fuse—not always an easy matter—and insert a new fuse. Often where a new fuse is not available the driver of the car will bridge the clips with a piece of copper wire or piece of other metal and then there will be no protection for the battery.

Fuses on the automobile are unnecessary when use is made of a new automatic lighting switch, brought out by the Hartman Electrical Manufacturing Company of Mansfield, Ohio. Combined with the lighting switch is a small automatic circuit breaker, which instantly breaks the circuit when a ground occurs and positively indicates this by throwing out a small button on the face plate. To close the circuit again it is only necessary to push the button in, and if it remains in this position, it is a certain indication that normal conditions have been restored. In other words, it performs the function of the fuse, but without the inconvenience and expense attached to replacing a blown fuse. The lights are controlled by means of a key which can be removed with the lights burning, thus preventing any tampering with them during the owner's absence. A similar type of switch is made for the ignition circuit, this switch being designed to prevent the draining of the battery should the driver fail to throw the switch off when the engine is stopped.

Motor-Driven Vegetable Paring Machines

The Maxim Manufacturing Company, 1727 Republic Building, Chicago, Ill., has developed several interesting types of motor-driven vegetable-paring machines, one of which is shown in the accompanying halftone. The cylinder in which the vegetables are placed is provided with a concrete lining. At the bottom of the cylinder is a disk which rubs off the skin of the vegetables in small bran-like particles, entailing, it is declared, no waste. A small stream of water is played on the vegetables while the peeling operation is going on. The No. 4 machine, illustrated, has a capacity of 30 lb., and is designed especially for large hotels, restaurants and institutions. The machine is equipped with ball bearings throughout. Direct drive is accomplished by a single set of gears (with a rawhide pinion running in a cut bell gear) making the machine practically noiseless. A Fort Wayne motor is utilized to operate the machine. The company has also developed other machines of different capacities. The No. 4-A machine has a capacity of 15 lb. and is designed especially for small hotels, restaurants and institutions. It weighs 150 lb.



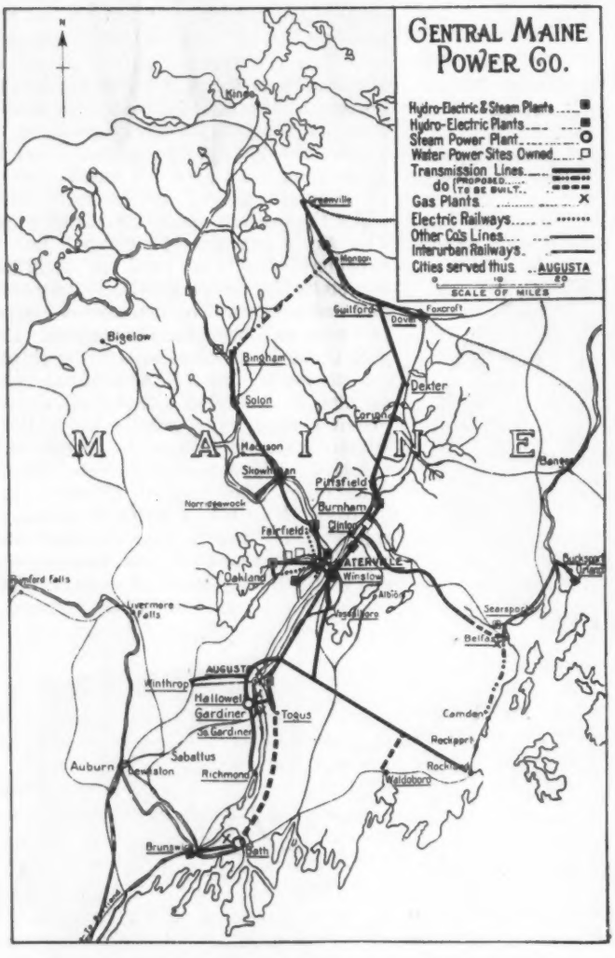
ELECTRIC VEGETABLE-PARING MACHINE

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Central Maine Power Company's Developments

The Central Maine Power Company, which operates throughout the Kennebec Valley, having recently acquired additions to its property in the southern and northern parts of the State, is planning to tie up its system and development plants so as to supply the central portion of Maine from the coast up to Moose Head Lake. The properties which the company acquired in



MAP OF CENTRAL MAINE SYSTEM SHOWING PROPOSED EXTENSIONS

the closing months of 1915 were the Bath & Brunswick Light & Power Company, the Waldoboro Water & Electric Light & Power Company, the Union Light & Power Company, and the Penobscot Bay Electric Company, which in turn owns the Greenville Light & Power Company. With these acquisitions the company is now doing business in nine out of the sixteen counties which make up the State and is serving a population of approximately 150,000.

Together with its subsidiaries the company owns and operates a number of hydroelectric plants having a combined rate of capacity of 15,000 hp. The plants are located on the Kennebec River and its tributaries, the Messalonskee and the Sebasticook; at the mouth of the Androscoggin River, on the tributaries of the Penobscot River, and on the small stream flowing into Penobscot Bay. Supplementary to the hydroelectric plants are a steam-turbine plant having a rate of capacity of 4000 hp., and other smaller steam plants having a combined capacity of 3500 hp. In addition the company has a long-term contract providing for a purchase of 2500 primary horsepower from the Shawmut Manufacturing Company located on the Kennebec River near Waterville.

The greater part of the property belonging directly and indirectly to the company is interconnected by a system of transmission lines aggregating 310 miles, and it is proposed to construct in the immediate future approximately 42 miles additional, as indicated on the accompanying map, in order to properly physically interconnect all of the properties.

It is the intention of the company to operate all of the hydroelectric plants which were formerly owned by the recently purchased companies, but holding them in reserve whenever it is possible to hold the water in storage. This will be done in order to make better use of the storage water, which heretofore has been unused in those plants where the storage was not under complete control.

An additional steam turbine unit of 2000 kva. capacity has been ordered for the steam plant at Farmingdale to make better preparations for low-water conditions. It is thought that all other future developments of this company will be hydroelectric, and it is expected at the present time that before long it will be necessary to erect a hydroelectric plant of considerable capacity.

Considerable progress has been made by the company in extending its lines into small towns. In 1915 extensions of this character were built or projected into Unity, Thorndike, Brooks, Monroe, Winterport, Belgrade, Athens and Cornville. Besides having lines to reach these villages it was found that an opportunity was thus offered to supply in considerable quantities the farms along the line. The financing of these extensions has been taken care of by the sale of preferred stock to residents of the towns. This work the company proposes to continue during 1916, and in this way expects to increase its income considerably, although it does not anticipate taking over any other companies.

Public Service Commission News

Idaho Commission

The Public Utilities Commission is now conducting an investigation into the increase in insurance rates in Idaho to determine whether or not the increase is the result of a combination of insurance companies in restraint of trade and in violation of the anti-trust law. The insurance companies claim that the increase was necessary, owing to the heavy losses and the risks they

had to carry. The commission will determine whether they were justified. The State insurance department reports that in 1915 premiums received amounted to $1,380,818.87, losses paid amounted to $850,966.72, and fees and taxes collected from insurance companies operating in Idaho amounted to $46,668.47.

Illinois Commission

The first number of Orders and Decisions of the State Public Utilities Commission of Illinois has just appeared. The commission begins with this issue the weekly publication of its orders and decisions, which will be distributed free for the time being. If the free distribution is hereafter found to be an undue burden, it may become necessary to place a nominal subscription price on this publication.

The commission, in utility-rate cases which have come before it, has fixed upon valuations and rates-of-return as per the following. No court has yet passed upon these valuations and rates-of-return:

Case	Classification	Valuation	Rate of Return, Per Cent	Rate of Depreciation, Per Cent	Remarks
City of Springfield versus Springfield Gas & Electric Company	Gas	$800,000	7.0	1.9	Appeal pending
City of Belleville versus St. Clair County Gas & Electric Company	Gas	265,000	7.25	3.0	Appeal pending
City of Belleville versus St. Clair County Gas & Electric Company	Electricity	350,000	7.25	4.4	Rehearing denied
City of Lake Forest versus Lake Forest Water Company	Water	150,000	7.0	1.6	Rehearing denied
In re Polo Mutual Telephone Company	Telephone	47,500	7.0	7.3	Rates in effect
In re Mowequa Telephone Company	Telephone	32,000	*	*	Rates in effect
H. S. Bucher versus Astoria Telephone Exchange	Telephone	7,000	7.0	7.8	Rates in effect
In re Gillespie Home Telephone Company	Telephone	12,323	**	**	Rates in effect
Woll versus Hullinger, San Jose	Electricity	10,400	2.0	4.5	Rates in effect

*Mowequa—Rates requested produce approximately 11.3 per cent for both return and depreciation.

**Gillespie—Rates requested produce approximately 9.3 per cent for both return and depreciation.

Colorado Commission

In a case involving the unreasonableness of the rates of the Arkansas Valley Railway, Light & Power Company within the city of La Junta, the Public Utilities Commission refused to admit any evidence pertaining to the value and cost of service of a municipally-owned and operated electric plant, and would not take any action in regard to estimating the cost of such proposed plant, as such matters were irrelevant to the proceeding before it.

In the valuation of the utility properties situated within the city of La Junta, the commission's engineer valued the city properties separately from the system of the utility and treated the city properties as an individual operating company purchasing current delivered at its substation by a transmission company, and found a rate of 2.4 cents per kilowatt-hour to be the amount at which the company could afford to deliver energy to substations located in the "Valley Division," by taking into account and apportioning on an equitable basis the company's investment in its generating plant, the transmission line, step-down transformer substation, and the cost of generation at the generating plant.

In determining the cost of this energy the commission was of the opinion that the exclusion, by the engineer in his appraisal, of the value of arc lighting transformers, motor-generating sets, and rotary converters used in connection with the street railway system of the company, was justified, inasmuch as such properties were simply energy-transforming devices used in the utilization of electrical energy by the different departments of the company, formed no part of the generating plant equipment, and were not used in any way in connection with the supplying of energy to the company's Valley Division substations.

By averaging the value of the stores and supplies over a period of one year, amounting to $1,500, and by taking one-twelfth of the total billing of the station for the previous fiscal year, which amount to $3,500, the commission found the proper amount to be allowed as working capital to be $5,000. The commission found the sum of $2,054.88, representing the cost of substation labor and miscellaneous supplies and expense, to be properly chargeable to the La Junta properties, such items being entirely local to these properties, and found the sum of $2,654.72, representing distribution, to be a proper charge as the entire expense of such distribution occurred within the city of La Junta.

The commission found that the sum of $500 was a proper amount to be deducted from distribution maintenance and included in depreciation, inasmuch as it was ascertained that depreciation was carried under the head of "maintenance" by the company, and as the commission ordered the company to set aside an annual depreciation fund the above amount would be a duplication of some of the items set forth under the head of "maintenance" in the company's operating expenses. Furthermore the commission was of the opinion that an item of $1,626.86, included in the operating expenses as "municipal ownership election expenses," while being a proper charge against the company—for the company has a right to protect its property through any legitimate expenditure—should not be charged against the properties in the city of La Junta as an expense for the year, but should be amortized over a period of years, if charged to the La Junta properties, but the commission was of the opinion that the amount was more properly chargeable to the entire system of the company, and ordered the company to so distribute it on the consumer basis, which amounted to 8.08 per cent, or $130.03, as applicable to the properties located within the city of La Junta.

A proper amount of depreciation to be set aside annually by the company for the La Junta properties was held to be $2,500, the present fair value of the properties having been found to be $80,000.

In valuing the properties of the Arvada Electric Company for rate-making purposes, the commission found that an error was made in including the sum of $3,158.78, the value of the transmission line, which was not the property of the company, and after deducting same found the present fair value of the properties of the company to be $31,224.22. The Colorado laws pertaining to public utilities do not contemplate the same rate for all classes of service, it was held, but in specific terms state that electric utilities under the direction of the Public Utilities Commission may establish graduated scale of charges for electric energy. The commission was of the opinion that any action on its part to reduce the rates of the Arvada company would be illegal, as the company would be unable to earn operating expenses, and such action would bring about a deplorable state of affairs in connection with the ownership and management of the company's property, resulting in temporary benefit only to the consumers. The preceding order in regard to this case was reported in the ELECTRICAL WORLD for last week.

British Electrical Utilities.—In the last eighteen years the British electric light industry has grown from thirty-eight private companies with a capital of $30,000,000 and thirty-three municipal plants with a capital of $10,000,000 to 276 private companies with a capital of $305,000,000 and 328 municipal plants with a capital of $260,000,000.

Dinner to Lord Aberdeen.—On Saturday evening, May 27, H. W. Fisher, electrical engineer of the Standard Underground Cable Company, Perth Amboy, N. J., tendered a dinner to Lord Aberdeen at the Cornell Club, New York City. Among the speakers, in addition to Mr. Fisher and Lord Aberdeen, were J. J. Carty, president of the A. I. E. E.; H. F. Stott, past-president of the A. I. E. E.; Dr. E. F. Northrup, professor of physics, Princeton University, and Dr. Leo H. Baekeland of the Naval Consulting Board.

Production of Lead in 1915.—The production of lead in the United States in 1915, according to the United States Geological Survey, amounted to 550,055 short tons, in comparison with 542,122 tons in the previous year. Of the amount produced there was available for consumption in the United States 426,751 tons in 1915, or 22,301 tons more than in 1914. The value of lead refined in the United States in 1915 amounted to $51,705,000 and in 1914 to $42,286,000. Most of the lead is smelted in three States, Missouri, Idaho and Utah, the amounts in 1915 being, respectively, 195,634 tons, 106,680 tons and 106,105 tons.

Large New Plant for Connecticut Company.—The Connecticut Company of New Haven, Conn., has awarded a contract to The J. G. White Engineering Corporation of New York for the engineering and construction of a new steam power plant at New Haven. The plans for this power station are being prepared for an ultimate capacity of 100,000 kws. Construction work on the foundation for this plant began last week. This plant will take the place of the company's old direct-current station at New Haven, and probably two substations will be built in New Haven for local distribution of current to the company's lines. The energy generated by this new plant will be in addition to that delivered to the company's lines by its other stations.

Illinois Utilities Offering Lower Rates for Cooking.—Many of the electric utilities of Illinois are exhibiting a marked and concentrated effort to reduce rates for electricity used for heating and cooking purposes. The rate is often fixed so that electricity can be made an active competitor of gas. Electric rates as low as 2.5 cents, net, per kilowatt-hour, with a $24 per year minimum bill, are offered to small residential consumers—a rate which is obviously in competition with gas at $1 per 1000 cu. ft. The utilities report some excellent results in small villages where complete saturation has already occurred. The only possibility of increased revenue in some of these hamlets appears to be in a large heating and cooking load.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Armour Tech Gets Half-a-Million Gift.—Announcement of a gift of $500,000 to the endowment fund of the Armour Institute of Technology by J. Ogden Armour was made at the commencement exercises on May 25. The effect of the gift is to make the institute, which was founded in 1892 by the late Philip D. Armour, father of J. Ogden Armour, a $3,500,000 school. The buildings and their equipment represent an investment of $1,500,000.

Experiment With Magnets for Loading Iron Ore Ships.—Using powerful magnets to lift pig iron from docks at Ashland, Wis., the steamer Cicoa, the only vessel on the Great Lakes equipped with loading magnets, last week took on a cargo of pig iron for Buffalo, and shippers are awaiting results of the experiment with interest as a possible settlement of future longshoremen trouble. The Cicoa has three magnets, each capable of lifting 1500 lb. and with four men to work them the loading proceeded faster and cheaper than under the old method.

Electrical Standardization Laboratory for Illinois.—The State Public Utilities Commission of Illinois has taken definite action looking toward the establishment of an electrical standardization laboratory to be located at Urbana, Ill., and to be installed and maintained jointly by the University of Illinois and the commission. If the authorities of the University of Illinois concur there will be established a convenient laboratory where the smaller utilities of the State may send instruments to be calibrated and standardized at a nominal cost.

New Mounting for Protecting Thermoelements.—A mounting for protecting laboratory thermoelements from damage by contamination or by mechanical strains has been developed at the Bureau of Standards, Department of Commerce, in connection with investigations of the expansion of substances on heating, and is discussed in scientific paper No. 276, entitled "Protected Thermoelements." Protective mountings with convenient heads for attaching the leads to the millivoltmeters that indicate the temperatures are common with industrial thermocouples; but the wires of the average couple to be seen in a physical or chemical laboratory are either entirely unprotected or else merely have portions adjacent to the junctions inserted in glass or porcelain tubes. The mounting regularly used in the expansion laboratory of the bureau, it is claimed, not only affords adequate protection to the thermoelement, but also adds greatly to the convenience of its use.

Washington to Vote on "Home Rule" Bill.—The certificate of necessity and convenience law passed by the last Washington State Legislature has been referred to a vote of the people and will be on the ballot for approval or rejection at the fall election. At the same time a bill will be voted on which has been introduced through the initiative and will seek to do away with certain functions of the Public Service Commission of Washington and lodge them in the hands of local authorities. This latter bill is of the "home rule" type.

Wireless With 500-Mile Radius for Police.—The installation of a wireless telegraph outfit having a 500-mile radius was begun recently at the New York City police headquarters, and is part of the general preparedness plans which the police commissioner is introducing. About twenty members of the Home Defense League have wireless apparatus on the roofs of their homes in various parts of the city near police stations. A code has been devised and messages will be sent to the Home Defense Leaguers, who will convey them to the station houses. In the near future wireless apparatus will also be installed in the important police stations.

Double Transformation Stops Telephone Trouble.—Lewellyn Owen, superintendent of the Central Illinois Light Company, Peoria, speaking before the Illinois State Electric Association convention, described a rather unusual installation on his company's lines. A single-phase line about 25 miles long had been built and arrangements had been made to supply it with energy from a bank of three-phase transformers. When the tap was made telephone circuits which were operating near the lighting wires began to give trouble, which was eliminated by inserting a step-down transformer and a step-up transformer in the single-phase line. To compensate for the drop in these transformers a voltage regulator was placed in the circuit so that the potential could be maintained at the receiving end of the single-phase line when the load came on.

To Raise $30,000 for Henry Monument.—At a dinner given in Albany recently by Dr. Charles B. Alexander of New York, a regent of the University of New York, in honor of John J. Carty, president of the A. I. E. E., and Prof. Michael Pupin, of Columbia University, plans were made for raising $30,000 to erect a statue of Joseph Henry. The guests inspected the instruments contrived and used by Henry while a teacher in the Albany Academy, in making the first successful experiments on long-distance electric transmission, beginning in 1827. Professor Pupin pledged himself to raise $15,000 if a like sum were raised in Albany to erect a bronze statue of Professor Henry in the park in front of the school in one of whose rooms the great discovery was made. Dr. John J. Carty and Regents Pliny T. Sexton, Charles B. Alexander, Chester S. Lord, Abram I. Elkus, James J. Byrne, Adelbert Moot, William Berri, and Albert Vanderveer each pledged $100.

Right of Abutting Owner to Interfere with the Erection of Poles and Wires.—A bill in equity to restrain an abutting owner from interfering with the erection of poles and wires was held by the Supreme Court of Pennsylvania (97 A. 82), in the case of the Duquesne Light Company versus Duff, to have been properly dismissed, since an electric light company under contract with a township of the first class to light the highways has no right to place its poles and wires on the highway without the consent of the abutting owners.

Customers' Deposit a Collateral Security for Faithful Performance of Contract.—In an action brought by the Georgia Railway & Power Company to recover from a lighting customer who had refused to pay his bill, a meter and some electric lamps, the Court of Appeals of Georgia held (88 S. E. 33) that the $5 deposit made by the customer was not for the purpose of paying any bills which he might owe the power company, but was made as collateral security for the faithful performance of all of the terms and conditions of the contract.

Use of Another Company's Poles in Stringing Wires.—In stringing telephone wires the use of a third company's neighboring pole by a lineman for mere convenience in doing his employer's work, without the knowledge or consent of that third company, does not impose upon the latter the duty to exercise reasonable care for the lineman's protection, it was held in the case of Mahaney versus City of Independence by the Kansas City Court of Appeals (183 S. W. 1117). The mere proximity of such a pole to the pole of the lineman's employer is not of itself an invitation to the lineman to use the other pole.

Franchise Requirement Not Applicable to Construction on Private Property.—The provision in an electric light company's franchise requiring that all wires on poles be not less than 25 ft. above the ground or street, and to be placed at a greater or lesser height above the ground whenever directed by the city, it was held by the Court of Appeals of Kentucky (183 S. W. 903), in the case of the Lancaster Electric Light Company versus Taylor, had reference only to the stringing of wires on streets or highways of the city, and not to the placing of wires on private property rented by the owner at different times for amusement purposes.

Contract with Foreign Corporations.—A contract by a foreign corporation which has not complied with the corporation laws for the sale of superheaters, requiring that the corporation not only manufacture and ship but also erect them in the buyer's plant in the State, is invalid as a contract for doing business in that State, it was held by the Supreme Court of Michigan (157 N. W. 408) in the case of the Power Specialty Company versus the Michigan Power Company, unless the foreign corporation suing on the contract can prove that the installation was, because of some peculiar quality of the apparatus, essential to the making of the sale.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Right of Appropriation and Condemnation of Water-Power Sites.—In the absence of statutory regulations to the contrary, the entire right of appropriation of water rights belongs to the company which first lays claim to the site and marks its route, it was held by the Supreme Court of North Carolina (88 S. E. 349) in the case of the Carolina-Tennessee Power Company versus the Hiawassee River Power Company. A power company does not forfeit the right to condemn property for public use because authorized to engage in private business.

Payment for Right to Do Business Not a Tax.—The Supreme Court of South Dakota held (156 N. W. 63) that a substitute tax levied upon public service corporations by law for all other taxes, including taxes upon earnings imposed by any law, ordinance or municipal regulation, does not include the percentage of the yearly receipts of a company which it has contracted to pay in consideration of the franchise granted it, because the amount so contracted for is not a tax within the meaning of the law, but is in the nature of a rental or compensation for the privileges granted.

Assignments of Cause in Compensation Case.—The Supreme Court of Wisconsin (157 N. W. 579) held that in a case where the employing city compensated an employee's widow for his death in full for all claims under the workman's compensation act, a cause of action against the tort-feasor who caused the death passed to the city and became its property, with which it might deal as it chose. The action was taken against the Milwaukee Electric Railway & Light Company in the case of a lineman employed by the city of Milwaukee who met his death through the alleged negligence of the electric light company.

Possibility of Inforcing Extra Charge for Reconnecting Service After Disconnection Because of Non-Payment of Bill.—A customer of the Georgia Railway & Power Company, failing to pay his bill, his service was disconnected, but he later offered to pay provided connection of service was restored. This the company refused to do unless a reconnection charge of $1 was paid, which the former customer refused to pay. He then also refused to pay his account that was in arrears. Suit was brought and the Georgia Court of Appeals stated (88 S. E. 33) that it thought this extra charge by the company could not be inforced, as the expense of turning off and on of the energy enters into the monthly rate charged by the company for the service.

Right of Suit for Obstruction to Streams.—Riparian owners who use water of navigable streams for power purposes were held by the Appellate Court of Indiana (111 N. E. 932) to have suffered a special injury from obstruction to the stream below their dam which impeded the flow of the water and lessened its power. They are entitled to sue to abate the public nuisance created by such obstruction.

Voltage of 110 Not Sufficient to Cause Death.—In an action brought for damages for death alleged to have been caused by coming into contact with a current of 110 volts, expert testimony that 110 volts of electricity were not dangerous and would not kill under any conditions, and that all voltage under 500 was not dangerous, was sufficient, it was held by the Supreme Court of Oklahoma (156 P. 654), to show that the action against the company was not supported by the evidence.

Negligence Arising from Low-Hanging Wires Along Highways.—It was held by the Supreme Court of Iowa (157 N. W. 206) that a telephone company in stringing its lines along a country highway must string the wires at such a height that a land owner, entitled to pass from his fields onto the highway, would not be in danger; and the company could not escape liability for injury occasioned by low-hanging wires on the grounds that the place was not a regular place for ingress and egress.

Extent of Liability to Furnish Power at Contract Price.—A railway company, under contract with the West Penn Electric Company to pay a demand charge of $2,000 based on ample power to operate not more than three double-truck cars at any one time, refused to pay in accordance with the contract, alleging that the power furnished was insufficient. In the suit the Supreme Court of Pennsylvania held (96 A. 719) that since the traction company in order to operate its cars was required to secure power from another source, the power company's bill should be reduced by the actual cost of such power.

Recovery for Continued Overflow of Land.—In a suit against the Alpena Power Company, Ltd., brought to recover for damages to property caused by the overflow of the land for a number of years, owing to an increase in the height of the dam, the Supreme Court of Michigan held (157 N. W. 21) that although recovery had already been had for the destruction of the meadow lands it does not prevent recovery for subsequent damage to the same land. Evidence was held to be insufficient to support a judgment when the damage was all shown to have resulted from the original tortious building of a dam. The plaintiff cannot recover the probable value of the crops which might have been grown on that land since these damages were speculative, but he could recover only the rental value. Moreover, this being the second recovery for the same tortious act, the rental value must be determined by the actual value of the land at the determination of the first action.

Yale Branch, A. I. E. E.—E. R. Hill, of Gibbs & Hill, consulting engineers, New York, addressed the members of the Yale branch of the American Institute of Electrical Engineers on May 19 on "Problem of Electrification of Railroads."

Los Angeles Section, A. I. E. E.—An illustrated talk on "Some Engineering Experiences in the Orient" was given by G. A. Reichard at the May 16 meeting of the Los Angeles Section of the American Institute of Electrical Engineers.

Cleveland Electrical League.—Members of the Cleveland Electrical League heard an address on conditions in various cities by Rabbi Louis Wolsey of the Euclid Avenue Temple. The address was delivered at the Hotel Statler on May 19.

Peoria Chapter, A. A. E.—A chapter of the American Association of Engineers is to be formed in Peoria, Ill. Seventy-five electrical, mechanical and chemical engineers have already agreed to sign. E. Stanley Terhune and Leonard Jeffries are heading the move.

Dallas Electric Club.—Howard Ardrey, vice-president of the National Bank of Commerce, New York City, spoke before the Dallas Electric Club on May 26 on the topic "What I Would Want to Know If You Asked Me for a Loan," in which he explained the basis of individual and business credit, small and large.

District of Columbia, Electrical Contractors.—On May 5 the Electrical Contractors Association of the District of Columbia held its first annual meeting and the following officers were elected to serve for the ensuing year:

President, E. C. Gramm; vice-president, Everett H. Henderson; treasurer, William B. Watzel; secretary, Joseph D. Campbell.

Chicago Electric Club-Jovian League.—At the regular Thursday luncheon of the Electric Club-Jovian League on May 18 Miss Edna Foley, superintendent of the Visiting Nurses' Association, was the speaker. In her talk on "Taking Care of the Other Half" she emphasized the advantages of the employer being in closer touch with his employees. At the meeting on May 25 Dr. S. S. Marquis talked on "The Ford Plan."

Empire State Gas & Electric Association.—There remain on the program of the Empire State Gas & Electric Association for the present year two electric meetings. One of the electric production committee at Watertown on July 14 and one of the electric distribution committee at Glen Falls on Sept. 8. This latter meeting closes the year 1915-1916 and the new year will open with the annual meeting in October.

New York Jovian League.—The last of the weekly luncheon meetings of the Jovian League of New York City until next fall was held last Wednesday at the Hotel Imperial. George W. Smith, Jr., an engineer who has spent the last six years in Mexico, told of some of his personal experiences in Mexico. A season closing meeting and dinner will be held next Thursday at Coney Island, after which the members will take in the Island's attractions.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1335 of this number.

New York Section, I. E. S.—W. T. Dempsey will read a paper on "Electric Street Lighting in New York" at a meeting to be held on June 8 at the 187th Street station of the United Electric Light & Power Company. There will be moving pictures showing New York methods of installation, construction and maintenance and lantern slides demonstrating how the equipment has been standardized for the various types of streets. Afterward an automobile inspection tour will be made through Manhattan and the Bronx to see interesting exhibits characteristic of the various types of New York installations, discuss street lighting problems and watch demonstrations under actual operating conditions.

Detroit-Ann Arbor Section, A. I. E. E.—The Detroit-Ann Arbor section of the American Institute of Electrical Engineers held a meeting in the Chemistry Building of the University of Michigan, on May 19. Prof. Alfred H. White, head of the department of chemical engineering, University of Michigan, delivered an address on "Electrical Precipitation of Smoke and Fumes," which was illustrated with experimental demonstrations and pictures. An interesting feature was the biennial exhibit of the college of engineering, which was in progress in various buildings and departments of work in the university. Interesting exhibits and operating demonstrations were arranged in the field of electrical, mechanical, civil and chemical engineering.

Pennsylvania Electrical Contractors.—The 1916 annual convention of the Electrical Contractors' Association of the State of Pennsylvania will be held at the hotel Sterling, Wilkes-Barre, under the auspices of the local association on June 21 and 22. The first morning will be given over to renewing acquaintances and inspection of exhibits followed by a luncheon given by the local association. A closed business session will be held in the early afternoon followed by an open session to which manufacturers and jobbers have been invited. The annual banquet will take place in the evening. At this time addresses will be made on the following topics: "Central Station Co-operation," "Value of National and State Membership" and "The Several Branches of the Electrical Industry." The second day will be given over entirely to amusements and sports.

Kansas Electrical Contractors.—The Electrical Contractors' Association of Kansas held its most successful annual convention on May 19 at Wichita, with an attendance of seventy-five, including contractors from neighboring states and others connected with the industry. The Jovian League and the local street railway and light companies joined with the electrical contractors in providing entertainment. The luncheon following the morning session was exclusively for contractors, while a banquet in the evening was a Jovian affair. There was a parade following the banquet, the degree team riding in the light company's truck, Jovians marching, the fifteen candidates for the rejuvenation riding in an animal cage borrowed, with a steam calliope, from a traveling show. The principal speakers of the business sessions, for contractors, were William B. LaBar, representative of the national association, who urged the co-operation of State association members; W. L. Hutchison of Kansas City, who also spoke for the national association and for the Jovian League, and H. A. Arnold of Wichita, whose talk touched on various phases of co-operation among the elements of the industry. The Kansas association membership has doubled in the past year, and 80 per cent of the State members are now members of the national association. Officers elected were: President, J. A. Mercer, Topeka; vice-president, William Cates, Hutchinson; secretary, R. M. Sutton, Wichita. Mr. Sutton is also Kansas director in the national association.

Pittsburgh Societies Urge Standard for Mill Motors.—A movement was started on May 20 at a combined meeting of the Jovian League of Pittsburgh with the Association of Iron and Steel Electrical Engineers of Pittsburgh to induce the makers of electrical work and machines for mills to standardize their products. It was stated that several different kinds of motors were available, but they differed in size as well as in construction. If the new movement succeeds it is expected much waste will be prevented and a great saving will obtain. At present, if a part of a motor cannot be supplied by its maker the entire motor must be thrown away and a new one purchased, it was said. The final resolution of the combined orders was to compel manufacturers to make a standard size motor, or the business of motor supplying will be thrown into one factory. This applies to the standardization of all other electrical material for iron and steel mills. At the banquet in the Fort Pitt Hotel representatives from all the steel plants of Pittsburgh and the Middle West were present. Papers on standardization were read by F. B. Crosby of the General Electric Company, C. T. Henderson of Milwaukee, B. Wiley of the Westinghouse Electric & Manufacturing Company, and H. F. Stratton of Cleveland. During the general discussion E. E. Friedlaender of the Edgar Thomson Steel Works and F. D. Eagen, president of the National Association of Iron and Electrical Engineers, spoke. The latter is connected with the Crucible Steel at Midland. During the afternoon the Jovians held a rejuvenation meeting and initiated a number of new members into the local league.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Demand for Electrical Goods Excellent

Every Section of the Country Finds Business Above Normal, with Credits and Collections Excellent

Electrical goods of every description are now finding a ready market, according to the reports received by the ELECTRICAL WORLD from reliable distributors situated in all of the important trade centers of the United States. With but few exceptions there are no high spots, every line enjoying a marked increased activity.

Where there were any high spots it was accounted for by industrial awakening. Motors, large power wire and cable, electric lamps in large quantities, etc., stood out in such cases as having a large demand.

Higher prices have undoubtedly acted to cut down business to a large extent. It is certain that where there was no immediate necessity for building or making improvements involving electrical material such promotions were held back pending more suitable prices.

On the other hand, to those who are buying electrical goods prices make absolutely no difference. That electrical materials have advanced 25, 40 and even 80 per cent within a short time does not stop their buying. Practically the only complaints that are heard are on the score of deliveries. Houses that received contracts for munitions of war, other shops that received contracts to supply the first with the necessary machinery, etc., all wanted electrical equipment and wanted it in a hurry. That was the beginning, and as the wave of industrial prosperity swept over the country greater and greater grew the demand for electrical equipment of every nature.

Nor has the demand as yet fallen off or even apparently reached its peak. Shops that for years have not turned a wheel are now working overtime and need large quantities of material. In all of this buying there is perhaps one article of those that outstand that should be mentioned, namely, the incandescent lamp. Owing to the large amount of night work made necessary by the volume of business, lamp sales have increased greatly.

In regions that are not industrial but almost entirely agricultural the demand for electrical products is either up to normal or above normal. Good crops, good prices and better wages for labor have combined to increase construction work, particularly of homes.

Other factors in the present situation are the growing civic pride of the nation finding an outlet in better and more extensive street lighting and white-way work; co-operation within the electrical industry culminating in Electrical Prosperity Week and Wire-Your-Home Month; education of the users and prospective users of electrical energy, and finally the high class of material now being placed on the market.

Credits and collections are uniformly excellent, being much better than for many months. It is thought that buyers are purchasing supplies out of their immediate earnings. Credits are still being watched very closely, but money is so much easier, wages so much better that the retailer gets his money quicker and he in turn pays the jobber quicker, etc. Excellent crops in the agricultural regions, increased mining activity, with exceptional prices and profits, revival of lumber business in the Northwest, and general increased activity have all combined to put much more money into circulation.

For convenience the reports received by the ELECTRICAL WORLD have been divided into East, Central and West. The East takes in the New England and Atlantic States; the Central takes in the Central States, and the West takes in the Pacific and Rocky Mountain States. In each case the city cited is merely the center of a certain territory, and in that city the business for that territory is transacted.

EAST

Philadelphia: Unusually large demand for electrical merchandise of all kinds, particularly from manufacturing concerns. Collections fairly good, but not as good as in February. Credit situation unchanged.

Buffalo: Volume of business large. Margin of profit above normal. High prices have postponed building activity for investment purposes. Decided activity in home building. Industrial construction calls for rush orders of large-sized wire and cable. Credits healthy. Collections good.

Pittsburgh: Demand large along general line of electrical supplies. Sales for first quarter 60 per cent above those for first quarter of 1915. Collections excellent. Credits restricted.

Washington: Business good. Difficulty in getting deliveries. Collections better.

Baltimore: Material improvement. Increased demand for machinery and general supplies. Prices better and customers willing to pay. Credits materially improved. Collections much better.

CENTRAL

Cincinnati: Business large and well sustained. Demand general. Collections satisfactory. Payments made out of income. Prices high, but buying continues.

New Orleans: Business slightly above normal. Trade spotty. Buying freer. Outlook optimistic.

St. Paul: Prices much higher. Business large. Credits and collections good.

Omaha: Demand slightly above normal and along general lines. Prices high which, it is thought, will probably hurt future demand. Collections slightly better than normal.

Milwaukee: General business normal. Demand for motors and wire (rubber-covered and weatherproof) large. Volume of business greater, due perhaps to increased prices. Building restricted. Collections normal.

Memphis: Conditions normal. Business conditions satisfactory. Agriculture not yet recovered from 1914 setback. Lumber interests at standstill, owing to stoppage of exports, in which most of their business was formerly done.

Indianapolis: Market stubborn on account of high price of copper. Collections and credit good.

Lincoln: Business conditions unusually good. Demand general. Credits and collections especially good.

WEST

Salt Lake City: Demand large. Considerable construction work by large central stations under way. Difficulty in getting deliveries. Credits and collections good. Mines working to capacity and farmers, both grain and sheep, doing very well.

Portland: Improvement during first quarter of the year. Not yet normal. Prospects encouraging. Credits need watching, but losses have been small.

Rights of Labor to Make Contracts

Chapter 778 of the Acts of 1914 prohibiting judges of courts from issuing an injunction in labor disputes unless it was apparent that irreparable damage would be done was declared unconstitutional on May 19 by the full bench of the Massachusetts Supreme Court. Chief Justice Rugg, who wrote the decision, declared:

"The right to make contracts to earn money by labor is at least as essential to the labor as is any property to other members of society. The courts must be open to all upon the same terms. No obstacles can be thrown in the way of some which are not interposed in the path of others. Re-

course to the law, all alike, without partiality or favor, for vindication of rights or redress of wrongs is essential to equality before the law."

The decision was made on the bill in equity of John Bogni and others against Giovanni Perotti and others. The plaintiffs are building laborers combined under the name of the General Laborers' Industrial Union 324 and affiliated with the Industrial Workers of the World. The defendants are members of the Hod Carriers, Building and Common Laborers' Union 209, affiliated with the American Federation of Labor. Bogni and his fellow-members alleged conspiracy on the part of Perotti and others to deprive them of their livelihood unless they joined the Laborers' Union.

The defendants justified their action as legal under the statute which is now pronounced invalid.

Manufacturing and Industrial

The Interstate Electric Novelty Company has moved from 29 Park Place, New York, to 104 South Fourth Street, Brooklyn, N. Y.

The Fahnestock Electric Company has recently moved its factory from 129 Patchen Avenue, Brooklyn, to larger quarters on Meadow Street, Long Island City.

A. & W. Electric Flag Business.—W. M. Knapp of the A. & W. Sign Company reports that his house has made 136 large electric flags since the beginning of the year.

The Albert P. Hill Company, advertising agent, has recently moved its office from the First National Bank Building to the Peoples Bank Building, Fourth Avenue at Wood Street, Pittsburgh, Pa.

The American Mineral Grinding Company, Lakewood Avenue, Atlanta, Ga., has recently been formed and is engaged in the sheet-mica and ground-mica business, being the only concern engaged in this business, according to a statement of Lawton Taylor, connected with the company, in the State of Georgia.

To Inaugurate a Big Dry-Battery Sales Campaign.—The Cleveland (Ohio) Battery & Electric Company, manufacturer of the "Hywatt" dry battery, which was recently described in these columns, is preparing to inaugurate a sales and advertising campaign among automobile users, as well as others who buy or handle batteries. An especially long life is claimed for the battery, as well as convenience in shape, the construction being rectangular instead of round.

Hoskins Manufacturing Company Opens New Branch Office in the East.—Due to the increasing demand for electric furnaces, pyrometers, hot plates and chromel resistor material, the Hoskins Manufacturing Company of Detroit has opened a branch office in Boston, located at 613 Equity Building. J. E. Hines is in charge. This is the third branch office the Hoskins Company has opened in the East. Other branches are maintained in New York, Pittsburgh and Chicago.

The Ward Leonard Electric Company, manufacturer of electric controlling devices, has recently moved into a new building at Mount Vernon, N. Y. The change in quarters has been necessitated because of the need of more floor space. The Ward Leonard Electric Company started manufacturing electric controlling devices in Bridgeport, Conn., in 1892. After two years in Bridgeport and three years in Hoboken, N. J., the company moved to Bronxville, N. Y., where its plant has been established since 1897. The new plant is 150 ft. from the New York City limits.

Fairbanks, Morse & Company.—At the annual meeting of the directors of Fairbanks, Morse & Company, 900 South Wabash Avenue, Chicago, Ill., held on May 17, the following officers were elected for the coming year: Chairman of the Board, C. H. Morse, Sr.; president, C. H. Morse, Jr.; first vice-president, W. E. Miller; vice-president, H. C. McClary; vice-president, H. J. Fuller; secretary and treasurer, F. M. Boughey; assistant treasurer, B. E. Cremerius, and assistant secretary, C. A. Meyer.

Orders for Large Turbo-Generator Unit and Electric Locomotive.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has recently sold to the Brooklyn Rapid Transit Company one 30,000-kw. turbo-generator unit and one 40,000-sq. ft. condenser. The Berwind White Coal Company has also recently purchased from the Westinghouse company six 13-ton locomotives, each of which is equipped with two No. 908 ball-bearing motors, and two 35-ton locomotives with three No. 909-C ball-bearing motor equipments.

Making Gas Engines in Larger Units.—The present tendency in the manufacture of gas engines, it is reported, is toward larger engines. One immediate result of this tendency is the lowering of prices of the smaller units, and advertising campaigns to move them. One large manufacturer of Kansas City is using much advertising space in such a campaign and is reducing his prices; several of his competitors are said also to be planning a co-operative advertising campaign, with prices similarly reduced, to meet his efforts. Practically all of the interested manufacturers are "mail order" sellers.

The Hartford Electric Novelty Company, 160 North Fifth Avenue, Chicago, Ill., has been incorporated under the laws of the State of Illinois with a capital stock of $20,000. The company will be engaged in the manufacture of electric novelties and talking machines. Among the devices which the company has developed are an electric lantern, an advertising device called "a magic mirror change holder," a window-display mirror in which at intervals the mirror disappears and the object being advertised is shown in five or more different positions, a dark-room lantern which can be operated by a No. 6 dry cell, an electric motor for talking machines, etc.

Forest City Electric Company to Erect New Factory Buildings.—It has recently been announced that the Forest City Electric Company, Cleveland, Ohio, has purchased real estate on Lakeside Avenue, near East Fifty-first Street, with a frontage of 250 ft. and a depth of 339 ft., and that the company has already filed plans with the city building department for a factory building which will cost about $40,000. The new building will be located at the west end of the property. It is expected that another building will be commenced on the east end by Nov. 1, and a third will be built the coming year. The company's plant is now at 5009 Windsor Avenue. The first building will have ground dimensions of 100 ft. by 224 ft. and will be of steel and concrete construction.

Electrical Supply Trade Is Booming in Detroit.—War prices now prevail in the wholesale electric supply business, according to W. G. Clarke of the A. T. Knowlson Company, Detroit, Mich. There has been an advance of from 10 to 50 per cent in nearly everything handled by the company, and glass materials also have been affected. "Despite the increase in price," said Mr. Clarke, "there has been a remarkable business expansion during the last few months, and the demand for electrical supplies is the greatest in several years. The number of building permits recently issued was large, and this is probably responsible for the increased demand. The advance has perhaps been most marked in copper and brass since the war outbreak. As these two materials enter into nearly all electrical fixtures, it has brought on a general price advance."

The Packard Electric Company.—J. E. Erickson has joined the sales organization of the Packard Electric Company of Warren, Ohio, and will cover the territory formerly in charge of Benjamin Smith, who retires. Mr. Erickson's experience in the electrical field dates back to 1903 when he entered the employ of the Boston-Edison Company, spending about a year with that concern. He was next connected with the engineering department of the Condit Electrical Manufacturing Company of Boston, first working in the New England territory and later he was transferred to Chicago, working with Thomas Grier, the Chicago agent of the Condit company. After two years in Chicago Mr. Erickson took charge of the Cleveland office of the Condit company, resigning in 1914 to go with the Cleveland office of the Western Electric Company, from which position he comes to the Packard Electric Company.

Prizes Awarded by American Museum of Safety.—In connection with the Third Exposition of Safety and Sanitation held last week under the auspices of the American Museum of Safety, at the Grand Central Palace, New York, awards were made to certain industrial organizations that

made conspicuous records in promoting the health and safety of their employees during the past year. The awards consisted of grand prizes, gold, silver and bronze medals and honorable mention. Among the concerns that received the grand prize were the Metropolitan Engineering Company, the New York Edison Company, the Nicholas Power Company, the Shur-Loc Elevator Safety Company and the Westinghouse Electric & Manufacturing Company. Some of the winners of gold medals were the Angel Elevator Lock Company, the Bureau of Municipal Research, the Consolidated Engine Stop Company, the Clipper Belt Lacer Company, the Hirsch Electric Mine Lamp Company, the A. G. Kaufman Manufacturing Company, the Kranz Manufacturing Company, the Life-saving Device Company, the New York Telephone Company and the Otis Elevator Company.

Orders for Electrically Operated Ice-Cream Freezers.—The Emery Thompson Machine & Supply Company 235 East Forty-first Street, New York, manufacturer of electrically operated ice-cream freezers equipped with open-circulating-brine bases, has recently received orders from the United States government for twenty-one machines provided with direct-motor drive. The company has also recently received several large orders from ice-cream factories throughout the country; as a result the company believes that the coming season will be a better and more profitable one than the past season. Owing to unfavorable weather the ice-cream business in 1915 did not come entirely up to the mark expected at the beginning of the season. The unsettled conditions created by the war, it is thought, may also have been partly the cause of the depression. In spite of these handicaps, the business during 1915 of the Emery Thompson Machine & Supply Company showed an increase over that of the previous year, and with the general boom in business now being felt everywhere, the company is looking for a better season in 1916.

A Novel Moving Window Display.—A novel and attractive window display is being furnished distributers of the Hotpoint product, by the Hotpoint Electric Heating Company of Ontario, Cal., to facilitate the sale of its vacuum cleaners during "Hotpoint Week," July 3-8. The display consists of the figure of a woman—"The Hotpoint Maid"—dressed in a neat, pink house-dress, and wearing a pretty dusting cap. The dress is attractively trimmed with white collar and belt on which appears in pink letters, "Hotpoint Vacuum Cleaner." "The Hotpoint Maid" is very much alive and has exceptional value as it demonstrates the suction power of the Hotpoint vacuum cleaner and to the onlooker it conveys the emancipation of woman from the drudgery attendant on keeping the house clean. By an interesting make-and-break device in the automatic mechanism, the figure is continually moving, being first seen deflated, in a crumpled up posture, representing the maid as being "all fagged out from using the broom." By means of air forced through the rubber hose attached to the dust bag of the cleaner, the figure is inflated and brought to an erect position, one hand pointing to the vacuum cleaner. In previous years "Hotpoint Week" has been held early in May. It will be the sixth of the company's special annual sales weeks.

Automobile Trucks for Long-Distance Hauling.—Recently the S. K. F. Ball Bearing Company, Hartford, Conn., utilized a fleet of Mack automobile trucks with trailers to ship 40 tons of ball bearings from New York to Hartford. These bearings, which were needed to fill rush orders from manufacturers of automobiles, textile machinery, machine tools, milling machinery and various other types of high-speed machinery, came from Sweden. On account of war conditions and delays in port, the shipment was behind schedule, and rather than suffer further delays due to the railroad embargo, the S. K. F. Company chartered eight automobile trucks to bring the 300 cases in which the bearings were packed from the piers at New York to Hartford. Until recently, the S. K. F. Ball Bearing Company was a purely sales organization, representing the Aktiebolget Svenska Kullagerfabriken of Gothenburg, Sweden. Of late years, the demand for S. K. F. bearings in America has been so great that it was found advisable to start an American plant. Last winter the erection of a factory building at Hartford was begun and a month ago the company's offices were moved from New York to Hartford. The installation of machinery at the new plant is now nearing completion and manufacturing operations will commence in the near future. The bearings made in Hartford will be exactly the same as those made in Sweden, for Swedish crucible steel will be imported and manufacturing equipment similar to that utilized in the Swedish plant will be employed.

Robertson Companies Occupy New Headquarters at Buffalo.—The Robertson-Cataract Electric Company, and the Robertson Electric Construction Company, on April 21 moved into their new four-story brick and steel fireproof structure at South Elmwood Avenue and West Mohawk Street, Buffalo, N. Y., where they are pioneers in a new retail location. The erection of the buildings proved to be one of the most rapid pieces of construction work ever accomplished. Possession of the property was obtained Oct. 1, 1915, and the structures were completed with the exception of some interior finishings, within five months. The Robertson companies have had an interesting growth. Beginning with a small co-partnership between J. D. Robertson and W. E. Robertson in December, 1899, known as the Robertson Electric Company, conducting a general electric construction business in the basement at 13 Niagara Street, the firm has grown until now it does a business in excess of $1,000,000 a year, with activities throughout North and South America. Fifteen years ago the partnership outgrew its initial quarters and moved to 190 Main Street, where a retail department was added. A year later the business grew to the point where it was advisable to conduct the business as two separate companies and the Robertson Electric Construction Company was incorporated to do electrical contracting, manufacturing and repairing—while the Robertson Electric Company was organized to do the wholesale and retail business in electric supplies and apparatus. At this time C. S. Sidway and W. Allan Gardner became actively associated with the company. Further expansion of the business made it advisable, in 1903, to acquire a three-story building on the Terrace, and for four years thereafter an additional building of the same size was rented, until finally the two companies occupied in all some five buildings. In 1906 Mr. Gardner retired and Ralph H. Sidway became associated and the control of the Cataract Electric Supply Company was acquired. Later this company was merged with the Robertson Electric Company, which, thereafter, was known as the Robertson-Cataract Company, and W. R. Huntley of the Buffalo General Electric Company became a director and vice-president. J. E. Montague of the Buffalo & Niagara Falls Light & Power Company was also elected to the board of directors. In the spring of 1909 the business was moved to the Tucker Building in Court Street, which was destroyed by fire last summer. This necessitated the finding of an immediate temporary location and the firm moved into the Curtiss Building and thence on April 21 to its present new home.

NEW YORK METAL MARKET PRICES

	May 23 Selling Prices Bid	May 23 Selling Prices Asked	May 29 Selling Prices Bid	May 29 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	136 0 0		126 0 0	
Prime Lake	28.50	to 29.00†	28.00	to 28.50†
Electrolytic	29.00	to 29.50†	28.25	to 28.75†
Casting	26.75	to 27.25†	26.25	to 26.75†
Copper wire base	32.50	to 33.50†	32.00	to 32.50†
Lead	7.50		7.50	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	24.50†		22.50†	
Spelter	14.92½	to 15.17½	13.55	to 13.80
Tin, straits	48.00		47.00†	
Aluminum, 98 to 99 per cent	57.00	to 59.00†	57.00	to 59.00†

OLD METALS

Heavy copper and wire	22.00 to 22.50†	21.00 to 21.50†
Brass, heavy	13.00 to 13.50†	12.50 to 13.00†
Brass, light	11.00 to 11.25†	10.50 to 11.00†
Lead, heavy	5.75 to 6.00†	5.75 to 6.00†
Zinc, new scrap	13.10 to 13.50†	11.50 to 12.00†

COPPER EXPORTS

Total tons to May 29 14,622

†Nominal.

Corporate and Financial

Detroit (Mich.) Edison Company.—An issue of $2,000,000 of 5 per cent first and refunding mortgage gold bonds due on July 1, 1940, is being offered at 101 and interest, yielding 4.93 per cent.

Ohio Gas & Electric Company, Middletown, Ohio.—The Ohio Public Utilities Commission has authorized the company to purchase the properties of the Middletown Gas & Electric Light Company, the Franklin Electric Light Company, the Leetonia Electric Company and the New Lisbon Gas Company and to issue $100,000 of common stock, $200,000 of 7 per cent preferred stock, $200,000 of its 6 per cent ten-year debentures and $500,000 of its first mortgage 6 per cent bonds, the preferred stock to be sold at not less than par and the other securities at not less than 86.25.

Puget Sound Traction, Light & Power Company, Seattle, Wash.—The Puget Sound district has recovered only slightly from the severe depression which began with the outbreak of the European war, according to the annual report of the company for the year ended Dec. 31, 1915. The lumber business was exceedingly dull, and conditions in the salmon industry in 1915 were the poorest for several years. Although present signs of improvement in general business may be of benefit to the company, prospects for a rapid recovery are not encouraging. A State prohibition law became effective on Jan. 1, 1916, and during an estimated period of several months of readjustment will reduce earnings, particularly in the light and power department. It is expected, however, that this loss will be largely offset by additional power sales under contracts already executed with large consumers. The company is also negotiating with prospective users of power, who, it is hoped, will locate in the region served, with the return of normal conditions. With the lapse of time and improvement in general business, jitney competition is expected to show further decrease, and in the steam heat, gas and coal departments, growth is anticipated during the year. The light and power revenue was reduced by partial or entire suspension of many industries. Several cement plants were thus affected, and practically all sluicing and dredging work, an important favor in 1914, was discontinued. Reduction in commercial and residential light and power rates in the city of Seattle on April 1 also contributed to the loss. During the year expenses were diminished by 4.4 per cent. The condensed results of operation for 1915 and 1914 for the company and its subsidiaries is as follows:

	1915	1914
Earnings:		
Railway department	$4,855,839	$5,714,565
Light and power department	2,202,337	2,258,887
Gas department	54,531	53,325
Steam heat department	312,699	320,548
Other earnings	134,176	103,649
Total earnings	$7,559,582	$8,450,974
Expenses:		
Operation	$3,144,738	$3,303,868
Maintenance	855,893	881,989
Taxes	754,132	821,151
Total	$4,754,763	$5,007,008
Net earnings	$2,804,819	$3,443,966
Interest charges	1,878,779	1,860,824
	$926,040	$1,583,142
Bond sinking funds	301,205	258,032
	$624,835	$1,325,110
Dividends paid on preferred stock	615,464	820,618
Dividends paid on common stock	.....	556,736
	$9,371	*$52,244
Net direct charges to reserves and surplus	44,827	7,408
	*$35,456	*$59,652
Prior surplus	755,702	833,121
	$720,246	$773,469
Replacement reserve	.....	17,768
Current surplus	$720,246	$755,701

*Deficit.

New Orleans (La.) Railway & Light Company.—In order to meet the demands of load growth and effect certain economies in operation, it is stated in the 1915 annual report, the company is now installing a 15,000-kw. turbine at its Central power house and three 1000-kw. rotary converters at its Claiborne power house. The decrease in net income is due mainly to jitney competition in the railway department. This started on Jan. 31, 1915, and continued during the year. The number of jitneys operated now is approximately 40 per cent less than last spring, which tends to bear out the impression that they cannot operate profitably under favorable conditions. On Sept. 29 the city was visited by one of the worst storms on record; operations were hampered and normal conditions were not restored in all departments until about three weeks after that date. On Dec. 1 the electric rates were reduced.

A comparative consolidated income account for the years ended Dec. 31, 1915 and 1914, follows:

	1915	1914
Operating revenue:		
Railway department	$4,198,235	$4,398,507
Electric department	1,489,015	1,427,295
Gas department	1,264,337	1,186,322
Total	$6,951,587	$7,012,124
Operating expenses:		
Railway department	$2,342,411	$2,341,420
Electric department	573,406	561,227
Gas department	494,956	526,224
Total	$3,410,773	$3,428,871
*Net operating revenue	$3,540,814	$3,583,253
Net operating revenue—outside operations	7,595	8,012
*Total net revenue	$3,548,409	$3,591,265
Revenue deductions:		
Taxes	$765,826	$761,223
Uncollectible consumers' accounts	10,251	9,000
Total	$776,077	$770,223
*Net operating income	$2,772,332	$2,821,042
Miscellaneous income	47,648	45,551
Gross income	$2,819,980	$2,866,593
Income deductions:		
Interest on funded debt	$1,752,906	$1,709,451
Other interest charges	22,653	15,627
Dividends on stocks of lessor company owned by others	4,101	4,084
Taxes on non-operating land and improvements	16,603	17,345
Other income deductions	16,650	7,341
Total	$1,812,913	$1,753,848
Net income before deducting charges for renewals and replacements	$1,007,067	$1,112,745
Charges for renewals and replacements	212,927	189,618
Net corporate income	$794,140	$923,127
Less dividends on stocks of subsidiary companies held by others	5,075	4,013
Balance of net income carried to surplus	$789,065	$919,114
Surplus, Dec. 31, 1914		$1,426,407
Credits		797,620
Total		$2,224,027
Debits		200,071
Surplus before deducting dividends		$2,023,956
Dividends		699,710
Surplus, Dec. 31, 1915		$1,324,246

*Not including charges for renewals and replacements.

Philadelphia (Pa.) Electric Company.—While the plan to further unify the Philadelphia Companies has been deferred for the present, it is expected that consideration will be given it during the present year, it is stated in the annual report for 1915. The total commercial connected load on Dec. 31, 1915, amounted to 3,958,529 50-watt equivalents, an increase of 461,820. The increase in the number of consumers during the year was 9350. The railway, railroad and other utilities connected amounted to 645,000 50-watt equivalents on Dec. 31, 1915, an increase over the preceding years of 100,000 50-watt equivalents. Comparative earnings for 1914 and 1915 were as follows:

	1915	1914
Gross earnings	$8,777,924	$8,160,025
Operating expenses, taxes, fixed charges and reserve for renewals and replacements	6,363,374	6,181,046
Net income	$2,414,550	$1,978,979
Cash dividends during the year	1,574,311	1,574,308
Surplus for the year	$840,239	$404,671
Previous surplus	1,471,747	
	$2,311,986	

Stevens County Power & Light Company, Colville, Wash.—The company has filed amended articles of incorporation, increasing its capital stock to $200,000.

New Utility and Industrial Companies

The Cascade Electric Service Company of Cascade, Wis., has been chartered with a capital stock of $20,000 by Otto, John and Minnie Schlenter.

The Dean Electric Construction Company of Oak Park, Ill., has been incorporated with a capital stock of $5,000 by William Dean, E. C. Grimes and W. Stevens Lewis.

The Pacific Electric Company of Aberdeen, Wash., has been incorporated with a capital stock of $8,000 by R. E. Boettiger, Homer V. Reynolds and Albim A. Peterson.

The Grayson Light & Power Company of Grayson, Ky., has been chartered with capital stock of $6,000 by J. A. Bagby, R. M. Bagby, J. W. Stovall, J. W. Lusby and G. E. E. Wolford.

The Mitchell Rail Anchor Company of Louisville, Ky., has been incorporated with a capital stock of $30,000 by William M. Mitchell, William M. Mitchell, Jr., and Henry O. Wieland. The company proposes to manufacture appliances for electric railroads.

The Saluda Public Service Company of Saluda, S. C., has been chartered with a capital stock of $25,000 to operate an electric-light plant. The officers are: T. D. Fulmer, president and general manager, and Eugene W. Able, secretary and treasurer.

The Bristol Electric Company of Bristol, Ind., has been incorporated by H. L. Hartenstein, J. C. Upton and L. H. Upton. The company is capitalized at $5,000 and proposes to operate an interurban system and supply electricity for lighting and heating purposes.

The Harlem Valley Light, Heat & Power Company of Pawling, N. Y., has been incorporated by G. Whittlesy, G. F. Green and A. N. Griffing of Danbury, Conn. The company is capitalized at $150,000 and proposes to supply electricity for commercial purposes, etc.

The Idaho-Washington Water, Light & Power Company of Boston, Mass., has filed articles of incorporation under the laws of the State of Massachusetts with a capital stock of $1,200,000. The incorporators are: Benjamin T. Stevenson, Linden B. Hardwick and Brooke C. Ulman.

The Quaker City Construction Company of Wilmington, Del., has been incorporated with a capital stock of $675,000 to acquire, construct and operate water-works, light and power plants. The incorporators are: S. S. Adams, Jr., H. M. Kennedy and M. B. F. Hawkins of Wilmington, Del.

The Oakland Light & Power Company of Oakland, Me., has been incorporated with a capital stock of $10,000 to generate and distribute electricity for lamps, heaters and motors. The officers are: Nelson C. Martin, president; Preston H. Martin, treasurer and Walter E. Mathews, clerk, all of Oakland.

The Commonwealth Utilities Corporation of Mankato, Minn., has been chartered by Halbert Merrifield of Mankato, Minn.; C. L. Owen, of Winnebago, Minn.; John E. DeWolf, John C. Meiners and Lyman W. Bernhard, all of Milwaukee, Wis. The company is capitalized at $200,000, and proposes to generate and distribute electricity for lamps, heaters and motors; also to manufacture and deal in electrical and gas fixtures, etc.

Trade Publications

Locking Lamps.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued Bulletin No. 15-18 which contains information on locking lamps.

Flow Meters.—Flow meters are described and illustrated in a large-sized catalog issued by the Republic Flow Meter Company, Philadelphia, Pa.

Steel Reflectors.—Bulletin No. 15-14, published by Harvey Hubbell, Inc., Bridgeport, Conn., describes and illustrates several types of steel reflectors.

Self-Contained Generator Set.—The Universal Motor Company, Oshkosh, Wis., is sending out an illustrated card containing information on its 4-kw. generator set.

Gasoline-Electric Automobile.—The Woods Motor Vehicle Company, Chicago, Ill., is sending out an attractively illustrated folder printed in colors which contains considerable information on its gasoline-electric car recently described in these columns.

Ball Bearings.—The Norma Company of America, 1790 Broadway, New York, is sending out a folder which gives information on ball bearings for electrical automobile accessories.

Electric Sales Week.—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out an illustrated catalog which describes the various advertising features of "Hotpoint Week," which will take place from July 1 to July 8.

Chandeliers.—The Beardslee Chandelier Manufacturing Company, 221 South Jefferson Street, Chicago, Ill., is sending out card sets CD-6-1 to CD-6-6, inclusive, which contain pencil sketches of ornamental types of electric chandeliers.

Alternating-Current Elevator Motors.—The Type C1 two-speed alternating-current elevator motors, manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., are described and illustrated in leaflet No. 3862.

Electric Ranges.—The Globe Stove & Range Company, Kokomo, Ind., has just issued an entirely new folder of directions for the use of Globe electric ranges. It contains information intended for the education of the range user.

Electric Cooking Equipment.—The Hughes Electric Heating Company, Chicago, has just issued an eighty-two-page catalog describing and illustrating its complete line of electric ranges, hot plates, water heaters and automobile warmers.

Direct-Current Motors.—The C. & C. Electric & Manufacturing Company, Garwood, N. J., has recently published Bulletin No. 101 descriptive of its direct-current motors of the four-pole, inter-pole type which are built in sizes of from 1 hp. to 125 hp.

Interior Telephones.—"Inter-Phones and Accessories" is the title of an illustrated catalog recently issued by the Western Electric Company, New York. The company has also just issued a complete catalog descriptive of telephone apparatus and supplies.

Organization of Underwriters' Laboratories, Inc.—The Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Ill., has issued an attractively illustrated bulletin entitled "The Organization, Purpose and Methods of Underwriters' Laboratories."

Winding Machinery.—The American Insulating Machinery Company, Philadelphia, Pa., has issued an illustrated catalog which contains information on winding machinery for insulating wire, wire-enameling machinery and special types of insulating machinery.

Alternating-Current Generators.—Bulletin No. 1098, issued by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., is descriptive of alternating-current generators of the engine type. Bulletin No. 1099 describes Type A B and Type A H belted alternating-current generators.

Electric Signs.—The National Electric Sign Company, 61 Hudson Street, Jersey City, N. J., has published an atractively illustrated bulletin printed in colors entitled "Put Out the Flag," which describes several types of electrically operated sign flags. The company has also issued Bulletin No. 210, entitled "The Talking Sign," and Bulletin No. 209, entitled "The Monogram Carriage Call."

Mining Supplies.—The Electric Service Supplies Company, Seventeenth Street and Cambria Street, Philadelphia, Pa., has just issued a 400-page catalog on mining and industrial electrical supplies. The book lists and illustrates a complete line of equipment for electric haulage in power, mining and large industrial plants as well as a complete line of miscellaneous electrical supplies for such concerns.

Electric Apparatus.—The Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, has recently issued illustrated Bulletin No. 49,600, which is descriptive of flexible steel armored conductors, flexible steel conduit, stamped steel boxes, fittings and tools; illustrated Bulletin No. 48706 on alternating-current two-phase and three-phase motors and controllers for flat-bed and small rotary printing presses, and illustrated Bulletin No. 48907 on Type I-5, 500-lb. electrically operated hoists.

New England

RUMFORD, ME.—The contract for construction of the hydroelectric plant of the Rumford Falls Power Company at Rumford, is reported to have been awarded to the H. P. Cummings Construction Company of Ware, Mass.

JEFFERSON, N. H.—The Bethlehem (N. H.) Electric Light Company, it is reported, is planning to extend its service to Jefferson.

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 17 for removing and renewing certain high-pressure steam piping in the power plant at Portsmouth, N. H.

TOWNSHEND, VT.—The Twin State Gas & Electric Company of Battleboro is contemplating extending its electric transmission lines to Townshend.

AMESBURY, MASS.—The town of Amesbury has voted to accept the proposal submitted by the Amesbury Electric Light Company for street-lighting for a period of five years. Under the terms of the new contract the company agrees to furnish 21 incandescent lamps of 400 cp. in place of the 21 arc lamps now in use, and to replace the 13 flaming arc lamps with 15 incandescent lamps of 600 cp., and to replace all 40-cp. incandescent lamps with lamps of 60 cp.

BEVERLY, MASS.—The Beverly Gas & Electric Company has asked for permission to extend its system on several streets in the city.

EAST HAMPTON, MASS.—The East Hampton Gas Company has begun work on an addition to its electric plant at Mount Tom to provide space for transforming equipment for new lines. The feed line will run from Granby to Mount Tom and two distributing lines will be erected to East Hampton Center, one over the side of the mountain and the other through the Manhan Valley.

NEEDHAM, MASS.—The installation of an ornamental street-lighting system from the center of the town to Needham Heights is under consideration.

NEWBURYPORT, MASS.—The Newburyport Gas & Electric Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to increase its capital stock by $57,000, the proceeds to be used for extensions to its plant.

NORTHFIELD, MASS.—The Board of Trade is considering the purchase of the local system of the Greenfield (Mass.) Electric Light & Power Company, to be owned and operated by the town, and securing energy from the transmission lines of the Connecticut River Transmission Company to operate same.

PASCOAG, R. I.—The board of trustees of the Rhode Island Company has voted to appropriate $45,000 to build and equip a substation in Burrillville, and to appropriate the same amount to erect a similar station in the Harmony section of Smithfield on the Providence-Checachet line. Contracts will soon be awarded for the work.

NEW HAVEN, CONN.—The Connecticut Company of New Haven has awarded the contract for the engineering work and construction of a new steam plant in New Haven to the J. G. White Engineering Corporation, 43 Exchange Place, New York. The plans provide for an ultimate capacity of 100,000 kw. The proposed plant will take the place of the direct-current power station in New Haven. It is expected that two substations will be erected in New Haven to distribute the energy generated to the Connecticut Company's lines.

WALLINGFORD, CONN.—The borough of Wallingford is contemplating the erection of a three-phase, 11,000-volt transmission line and will be in the market for line material, including 18 miles of No. 6 B. & S. bare copper wire, insulators, etc.; also for two 150-kva. transformers Scott connected, two phase to three phase, 2200/11,000 volts, three 75-kva. transformers, 11,000/460/230 volts, lightning arresters, switches, etc. It is also proposed to erect a radial chimney, 90 ft. high by 4.5 ft. in diameter; a brick store house at the steam generating plant and the installation of sluice gates at the hydroelectric plant. A. L. Pierce is superintendent and electrical engineer.

Middle Atlantic

BUFFALO, N. Y.—The Seneca Street Business Men's Association has petitioned the City Council to install a new street-lighting system on Seneca Street.

BUFFALO, N. Y.—The High Street Taxpayers' Association has petitioned the City Council for the installation of inverted magnetite arc lamps on High Street.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ELIZABETHTOWN, N. Y.—The local electric-light plant, owned by C. M. Wood, has been purchased by J. L. Webster. The new owner proposes to enlarge and improve the plant and establish a 24-hour service.

FLUSHING, N. Y.—Preparations are being made by the Nathan Manufacturing Company of New York for the erection of a large manufacturing plant on Flushing Creek in Flushing, consisting of a main manufacturing plant made up of a series of units, connected by a central craneway, each combined unit two stories in height, with a total length of 320 ft. by 60 ft. wide; also a four-story office building, a foundry, large garage, docks, power house, etc. The cost of the buildings is estimated at about $500,000.

NEW YORK, N. Y.—Bids will be received by Marcus M. Marks, president of the borough of Manhattan, Room 2032, Municipal Building, New York, until June 9 for furnishing and installing an electric elevator and equipment in court house located at 170 East 121st Street, borough of Manhattan. Blank forms, specifications, etc., may be obtained at the office of the auditor, offices of the Commissioners of Public Works, Room 2141, Municipal Building.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Eleventh Floor, Municipal Building, New York, until June 16 for furnishing and installing underground lead-covered feeder cables in the southwest section of the borough of Manhattan. Bids will also be received at the same time and place for furnishing underground lead-covered feeder cables in the southeast section of the borough of Manhattan. Blank forms and further information may be obtained at the office of the Fire Department, Municipal Building.

PINE BUSH, N. Y.—The Wallkill Valley Electric Light & Power Company of Walden is contemplating extending its transmission lines to Pine Bush. C. Fred Fowler is manager.

ROCHESTER, N. Y.—Bids will be received by Col. Franklin W. Ward, secretary of State Board of Armory Commissioners, 158 State Street, Albany, until June 27 for construction, plumbing and drainage and electric work for armory for Troop H, First Cavalry, N. G. N. Y. Drawings and specifications may be consulted at the Armory of Troop H, First Cavalry, Exposition Park, Rochester; the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City, and at the Department of Architecture, Capital, Albany, N. Y.

CATASAUQUA, PA.—At an election held May 16 the proposal to issue $50,000 in bonds for the construction of a municipal electric-light plant was carried.

ERIE, PA.—The Erie Lighting Company of Erie has applied to the Public Service Commission for permission to issue $350,000 in capital stock, of which $261,000 will be used for refunding purposes and the remainder for completion of an addition to its plant.

GREENVILLE, PA.—Plans are being prepared by Pearson-Erhard & Co. of Boston, Mass., who recently purchased the property of the Mercer County Light, Heat & Power Company of Greenville, for the construction of a central power station, to cost about $100,000.

HAZLETON, PA.—The City Council has awarded the contract for street-lighting to the Hazleton Electric Company. Preparations are being made by the company to install an ornamental lighting system and for the erection of incandescent lamps in various sections of the city.

PHILADELPHIA, PA.—At an election held May 16 the proposal to appropriate $67,000,000 for port and transit development and $47,000,000 for general improvements was carried.

PHILADELPHIA, PA.—The contract for the complete electrical equipment for the office building at Sixteenth and Sansome Streets, has been awarded to the United Electric Construction Company of Philadelphia.

PHILADELPHIA, PA.—The contract for the construction of a new power house on Ninth Street, above Brown Street, 30 ft. by 54 ft., one story, for the Powers-Weightman-Rosengarten Company, has been awarded to B. C. Ballinger & Co.

PHILADELPHIA, PA.—A permit has been granted for the erection of a one-story, 72 by 46 ft. power plant on Pennypack Creek, east of Frankford Avenue, for the Summerdale Dyeing & Finishing Works, to cost $9,500. The Hogg Construction Company, 1634 Sansome Street, is contractor.

PITTSBURGH, PA.—In compliance with a resolution passed by the City Council recently Robert Swan has submitted a report in which the cost of a municipal electric plant to meet the demand of the city would cost about $16,000,000. The estimate showed that $9,000,000 would be required for the distribution system and $7,000,000 for the installation of a 100,000-kw. generating plant.

POLK, PA.—Bids will be received by the superintendent of public buildings and grounds, State Capitol Building, Harrisburg, until June 13 for furnishing materials and labor for the reconstruction of laundry building and equipment, and power house, which was damaged or destroyed by fire Oct. 16, 1915, at the State Institution for Feeble-Minded of Western Pennsylvania, located in Polk. Plans and specifications may be obtained on application to J. M. Murdoch, superintendent, State Institution, Polk, Venango County, Pa., or to the superintendent of public buildings and grounds, Harrisburg.

SHENANDOAH, PA. — The Borough Council has awarded the contract for street-lighting to the Shenandoah Gas & Electric Company for a period of ten years. Arc lamps will be used and it is understood that the lamps now in use will be replaced with new lamps.

BUTLER, N. J.—The Borough Council is considering extending the municipal electric-light service into Pequannock Township.

ELMER, N. J.—The installation of an electric-light system in Elmer is reported to be under consideration.

FREEHOLD, N. J.—The Board of Public Utilities has granted the Monmouth Lighting Company of Freehold permission to sell $26,700 in bonds.

MAYS LANDING, N. J.—The Delaware & Atlantic Telephone Company has been granted a 50-year franchise for the installation of an underground conduit system and right-of-way along the county roads for new pole lines.

NEWARK, N. J.—Extensive improvements are contemplated to the power plant of the Central Dyestuff & Chemical Company, on Plum Point Lane.

NEW BRUNSWICK, N. J.—Bids will be received by the Commissioners of the City of New Brunswick, at the Commissioners' Council Chambers, Court House Building, Paterson Street, New Brunswick, until June 6 for designing, construction and erection of one motor-driven centrifugal pumping unit of 3,000,000 gal. per 24 hours capacity and two motor-driven centrifugal pumping units of 6,000,000 gal. per 24 hours capacity each, against a total combined head of 100 ft., together with all switchboards, wiring connection, suction and discharge piping and other appurtenances, in accordance with specifications on file in the office of Asher Atkinson, city engineer, 10 Paterson Street, New Brunswick.

PATERSON, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 23 for a conduit and wiring system, lighting fixtures, etc., at the United States post office at Paterson, N. J. For details see proposal columns.

TRENTON, N. J.—Bids will be received by the State House Commission at the office of the comptroller of the State of New Jersey, Trenton, until June 13 for alterations to the exterior and interior of the old barracks in accordance with plans and specifications prepared by Richard Stockton, commissioner of charities and correction. Separate bids to be submitted for general plumbing, steam heating and electrical work, etc.

VINELAND, N. J.—The Borough Commissioners have decided to engage an engineer to prepare plans for extensions to the municipal electric-light plant, involving an expenditure of about $40,000.

DOVER, DEL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 19 for a new heating apparatus, plumbing changing, etc., in the United States post office at Dover, Del. For details see proposal columns.

ELKRIDGE, W. VA.—The M.-B. Coal & Coke Company is planning to rebuild its electric power plant recently destroyed by fire. Contracts for machinery, it is understood, have been placed. L. C. Tippett of Kimberly is manager.

WHEELING, W. VA.—The service committee of the City Council has recom-

mended a bond issue of $5,000, the proceeds to be used for improvements to the municipal electric-lighting system.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 22 for the installation complete of an electric passenger elevator in the United States post office and court house at Opelika, Fla.; and an electric passenger elevator in the United States post office, court house and custom house at Corpus Christi, Tex. Drawings and specifications may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Washington, D. C., Schedule 9710—50 chestnut telephone poles; Schedule 9711—6750 lb. lead pipe; Schedule 9710—one panel feeder and equipment, 17,000 ft. weather-proof copper wire. Newport, R. I., Schedule 9715—10,000 ft. iridium platinum wire, 15,000 ft. ebonite tubing. Boston, Mass., Schedule 9728—miscellaneous black and galvanized plow steel wire. Brooklyn, N. Y., Schedule 9729—5300 ft. lap-welded steel tubing; Schedule 9718—50 parabolic searchlight mirrors; Schedule 9732—20,000 ft. double-conductor wire, 47,000 ft. twin-conductor wire; Schedule 9728—18 portable electric radial drills; Schedule 9723—three blowers, 120 volts, direct current. Brooklyn, f.o.b. works, Schedule 9716—19,000 ft. lap-welded pipe steel. Philadelphia, Pa., Schedule 9720—5000 solid arc-lamp carbons, 10,000 ft. flexible cord for portables; Schedule 9713—two gasoline motor trucks, 1000 lb. Brooklyn, Norfolk, Schedule 9728—ship and motor boat bells. Charleston, S. C., Schedule 9718—four sets steam-turbine-driven blowers. Guantanamo Bay, Schedule 9709—one combination dry and wet grinder. Applications for proposals should designate the schedule desired by number.

North Central

ADRIAN, MICH.—Plans are being considered by the Lawrence Gas & Electric Company for the erection of a new power plant and additions to its gas plant.

BATTLE CREEK, MICH.—The H. B. Sherman Manufacturing Company is planning the erection of a large addition to its plant at Barney and Kalamazoo Streets, including a new power plant which will supply power for operating and lighting all its factories.

GRAND RAPIDS, MICH.—Preparations are being made by the Universal Power Company, recently organized, to issue $150,000 in bonds and stocks, recently authorized by the State Railroad Commission. Work, it is reported, will begin immediately on the erection of an electric transmission line, 80 miles long, to connect towns in the counties of Mecosta and Montcalm with the power plant to be erected near Croton. A water power plant will also be constructed near Howard City. The company proposes to supply energy to 24 towns in the above named counties. James E. Tobin of Gladwin is president, and J. M. Donahue of Grand Rapids is secretary.

MENOMINEE, MICH.—The contract for the construction of the John N. Davis High School and Manual Training School, 200 ft. by 122 ft., three stories high, has been awarded to G. A. Gustafson of Norway. The contracts for heating, electric wiring and clock stations, and plumbing have not yet been let.

SAGINAW, MICH.— The City Council has authorized the installation of 164 additional ornamental lamps in different sections of the city. The Consumers Power Company has the contract for street-lighting.

DESHLER, OHIO—Bonds to the amount of $22,000 have been voted for the installation of a municipal electric-light plant and $33,000 for water-works system.

GIRARD, OHIO—The installation of a municipal electric-lighting system is under consideration.

SHELBY, OHIO—Extensive additions, it is reported, will be made to the plant of the Ohio Seamless Tube Company of Shelby, including the erection of a new building, 200 ft. by 600 ft., at a cost of about $500,000. Arrangements have been made to obtain energy from the American Gas & Electric Company.

XENIA, OHIO—Plans have been submitted to the City Council by the officials of the Dayton (Ohio' Power & Light Company for the installation of an ornamental street-lighting system in Xenia.

ASHLAND, KY.—The Ashland Iron & Mining Company, which was recently awarded a contract for an open-hearth steel plant to cost $1,500,000 and a finishing mill, to cost $750,000, has entered into a contract with the Ohio Valley Electric Company of Benwood, W. Va., for energy to operate the proposed plant.

LOUISVILLE, KY.—The report on the heating and lighting plant of the jail and armory prepared by Brinton B. Davis, architect, recommends the installation of an entire new plant, at a cost of about $60,000.

GOSHEN, IND.—Bids will be received by the Board of Commissioners of Elkhart County, Court House, Goshen, until June 6 for electrical wiring of the county infirmary. Plans and specifications are on file at the office of the county auditor.

HUNTINGTON, IND.—The Public Service Commission has authorized the city of Huntington to issue $16,900 in bonds, the proceeds to be used to pay for the installation of an ornamental lighting system.

NASHVILLE, IND.—The Public Service Commission has authorized the town of Nashville to issue $2,000 in bonds for the installation of a municipal electric-light plant.

AURORA, ILL.—The city of Aurora has granted the Smith Power & Light Company of Arlington, Iowa, a franchise to install an electric-lighting system here.

DIXON, ILL.—The Brown Shoe Company of Dixon is planning to equip its plant for electrical operation this summer. A new engine room will be erected, equipped with new boilers and dynamo, etc. A new electric system for collecting dust will also be installed. The cost of the work is estimated at $35,000.

NORMAL, ILL.—The installation of a municipal electric-light plant in Normal is reported to be under consideration.

ONEIDA, ILL.—The contract for the construction of the new electric-light plant in Oneida has been awarded to the Skagg-Reagan Electric Company of Helena, Tenn.

BIRCHWOOD, WIS.—The town of Birchwood has contracted with the Wisconsin-Minnesota Light & Power Company of Chippewa Falls to furnish electricity for street-lighting and commercial purposes.

WAUKESHA, WIS.—The installation of a new fire station and alarm system is under consideration.

WESTBY, WIS.—Bids are being asked, it is reported, by the village of Westby for the installation of an ornamental street-lighting system.

LONG PRAIRIE, MINN.—The Little Falls (Minn.) Water Power Company of Minnesota has been granted a franchise to supply electricity in Long Prairie. The company was also given a contract for street-lighting. T. C. Gordon of Little Falls is manager.

MONTEVIDEO, MINN.—The Minnesota Valley Power Company is reported to have purchased the engine rooms, including engines, of the Chippewa Milling Company, which it will remodel and enlarge. The mills of the Chippewa company will be operated by electricity.

NORTHFIELD, MINN.—The Northern States Power Company, Faribault division, is contemplating the erection of a high-tension transmission line between its switching station at Waterford and the substation in Northfield, so that the St. Paul and Cannon Falls may be controlled locally and to prevent the interruption of the service in the northern district.

PERHAM, MINN.—The town of Perham, it is reported, has decided to sell the municipal electric-light plant to the Otter Tail Power Company of Fergus Falls. A franchise has been granted the company to supply electricity in Deer Creek. The company proposes to erect transmission lines to Deer Creek and Perham, through Underwood, Battle Lake, Clitherall, Vining and Henning.

ROCHESTER, MINN.—The installation of an ornamental street-lighting system is under consideration by the City Council.

ST. PAUL, MINN.—Negotiations are under way between the St. Paul & Southern Electric Railway Company and the Chicago & Northwestern Railway Company whereby the former will lease the branch line of the latter extending from Zumbrota to Rochester, 26 miles long. If taken over by the electric railway company it will be equipped for electrical operation.

ELDORADO, IOWA—The Iowa Railway & Light Company of Cedar Rapids has applied to the City Council for a franchise in Eldorado.

KEOKUK, IOWA.—The Keokuk Electric Company, it is reported, will replace the wooden poles with steel towers on the transmission lines between Alton and Calhoun County.

MOUNT AYR, IOWA.—The David Fisher Company of Davenport has taken an option on the property of the Mount Ayr (Iowa) Light & Power Company. If the deal goes through the former company will rebuild the power plant and extend transmission lines to Diagonal, Tingley and other towns and villages in this vicinity. The cost of the proposed work is estimated at from $20,000 to $30,000.

AURORA, MO.—The Lawrence County Light, Water & Cold Storage Company of Aurora is planning to extend its transmission lines to the mining districts in this territory. The company has recently made arrangement to secure energy from the Ozark Power & Water Company of Branson.

BROOKFIELD, MO.—Plans are being considered for the installation of a municipal electric-light plant and for improvements to the water-works system.

CARTHAGE, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 22 for a new boiler in the United States post office at Carthage, Mo. For details see proposal columns.

KIRKWOOD, MO.—The Board of Aldermen has granted the United Railways Company of St. Louis permission to erect a substation at Washing and Fillmore Avenues.

PIERCE CITY, MO.—The City Council has granted the Ozark Power & Water Company of Branson a franchise in Pierce City and has entered into a contract with the company to supply energy to the municipality. For the past 20 years the city has been served by a municipal plant.

PRINCETON, MO.—Bonds to the amount of $12,000 have been voted for improvements to the municipal electric-light plant and water-works system.

ASHLEY, N. D.—The North West Public Service Corporation has submitted a proposal to the Town Board offering to construct and maintain an electric-light plant in Ashley if granted a 20-year franchise. W. G. Woodruff of Ashley is president of the company.

HOWARD, S. D.—Bonds to the amount of $25,000 have been voted for the purchase of the local electric-light plant. Improvements will be made to the plant, including the installation of a new engine.

WENTWORTH, S. D.—The Flandreau (S. D.) Light & Power Company is reported to be planning to build an electric-lighting plant in Wentworth.

BELVIDERE, NEB.—The City Council is negotiating with the Meyer Hydro-Electric Power Company of Oak to furnish electricity in Belvidere. Bonds have been issued for the installation of an electric-lighting system. For further information address the city clerk.

BLUE HILL, NEB.—Plans are being prepared for improvements and extensions to the municipal electric-light plant, to cost about $7,000. New equipment, including pumps, engines, generators, boilers, etc., will be installed. R. A. Bradley & Company of Hastings are architects.

CHADRON, NEB.—Bids will be received until June 23 by the board of education for construction of addition, three-story and basement, 60 ft. by 85 ft., to the Normal School at Chadron, including electric-wiring, steam heating, etc., to cost about $50,000.

OAK, NEB.—The Meyer Hydro Electric Power Company will supply electricity in Rankin in a short time. The company has furnished electrical service in the towns of Edgar and Davenport since the first of the year. Ernst Meyer is president of the company.

OMAHA, NEB.—Extensive improvements are contemplated by the Omaha & Council Bluffs Street Railway Company, to cost about $250,000.

WILSONVILLE, NEB.—Bonds to the amount of $6,000 have been voted for the installation of a municipal electric-light plant.

CLIO, KAN.—The Council is considering calling an election to submit to the voters the proposal to secure electricity from the plant in Lineville.

ELKHART, KAN.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-light plant in Elkhart.

LANE, KAN.—Stephen Needham is contemplating enlarging his plant to supply electricity for street lighting. The plant is a small one, operated by an automobile engine.

OBERLIN, KAN.—The towns of Jennings, Clayton and Norcatur are considering securing electricity to operate local systems from the municipal electric plant in Oberlin.

Southern States

TARBORO, N. C.—Plans for the proposed improvements to the municipal electric-light plant provide for the installation of a 500-kw. turbo-generator set, at a cost of $23,000. William Platt of Durham, N. C., is consulting engineer.

ARMUCHEE, GA.—The Armuchee Mills, including flour mill, saw mill, cotton gin and electric plant, were recently destroyed by fire. The electric plant supplied electricity for lighting the city of Armuchee.

ATLANTA, GA.—Bids will be received at the office of the superintendent of prisons, Department of Justice, Washington, D. C., until June 19 for furnishing at the United States penitentiary at Atlanta, Ga., an addition to main switchboard, power tablets, etc., and electric feeders for light and power to west main cell wing, in accordance with specifications on file in the above office. F. H. Duehay is superintendent of prisons.

ROME, GA.—An ordinance has been passed by the City Commissioners providing for a special tax of 5 mills to secure $50,000 to establish a municipal electric-light plant.

DE FUNIAK SPRINGS, FLA.—At an election held recently the proposal to issue bonds for extension to electric-lighting system was defeated.

PENSACOLA, FLA.—The City Commissioners have authorized J. L. Sweeney, superintendent of the city water department, to purchase a generator set and switchboard panel to be installed at the water pumping station for the purpose of supplying electricity for lighting the water-works plant and property.

TAMPA, FLA.—The Tampa & Eastern Traction Company, recently incorporated with a capital stock of $750,000, proposes to construct and operate an electric railway from Tampa to Lakeland, via Gary, Mango, Seffner, Dover, Plant City, Youmans and Winston; also to supply electricity for lamps, heaters and motors. F. W. Cole is president.

TAMPA, FLA.—The City Council has granted the Export Phosphate Railway & Terminal Company a franchise to construct a traction line in Tampa. The franchise provides for equipping the railway for electrical operation within two years from date of starting operations. The American Agricultural Chemical Company of New York, is said to be interested in the project. H. L. Pierce is in charge.

CROSSVILLE, TENN.—The Skaggs-Reagan Electric Company of Helena, has secured the contract to install an electric-light plant in Crossville.

TRIMBLE, TENN—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-light plant.

DECATUR, ALA.—An election will be held June 15 to submit to the voters the proposal to issue $50,000 in bonds for the construction of an electric-light plant. Xavier A. Kramer of Magnolia, Miss., is engineer.

MOBILE, ALA.—The report submitted by Ford, Bacon & Davis, consulting engineers of New Orleans, La., on harbor and port improvements recommends the following: Two apron wharves, to cost $114,480; two frame warehouses, $30,300; railroad tracks, bulkhead and connections to railroads, $17,875; roadway, $15,000; dredging turning basin, $83,500; overhead runways extending from Dauphin to St. Anthony Street, along Front Street and extending along St. Francis and St. Louis Streets, $92,708, including 1150 lin. ft. overhead runways constructed of concrete, $51,750. The cost of constructing an ultimate overhead runway and telpherage system for serving wharf houses, all connected to municipal wharves, including cost of conveying apparatus and elevator runways, is estimated at $387,884.

CLARKSDALE, MISS.—Bids will be received by A. C. Tuttle, city clerk, Clarksdale, until June 13 for the following equipment: (1) One 500-kw., three-phase, 60-cycle, 2300-volt turbo-generator unit with direct connected exciter, including jet type condenser, switchboard panel and necessary instruments and equipment; (2) cooling tower for above equipment; (3) one 200-kw. generator and uniflow engine (directly connected) with 125-volt exciter, switchboard panel and all necessary instruments and equipment. For details see proposal columns.

COLUMBUS, MISS.—The property of the Columbus Railway, Light & Power Company has been purchased by Memphis and Greenville capitalists. The new owners, it is understood, have taken over the system and will make extensive improvements and increase the car service. The new officers are: R. T. Fant of Memphis, president; L. K. Salsbury, vice-president; R. B. Claggett of Greenville, secretary and treasurer, and Charles Hays of Columbus, manager.

HELENA, ARK.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 26 for new heating system, plumbing, etc., in the United States post office at Helena. For details see proposal columns.

WARREN, ARK.—The City Council has granted L. J. Burbridge of Warren a franchise to install and operate an electric-light plant in this town.

ALLEN, OKLA.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric-light plant.

ALVA, OKLA.—The Council is considering submitting to the voters the proposal to issue bonds for an electric-light plant and water-works system, to cost about $25,000.

OKMULGEE, OKLA.—Preparations are being made by the Okmulgee Ice & Light Company for the installation of an ornamental lighting system. The company is also considering rebuilding its power plant.

AUSTIN, TEX.—Luminous arc lamps have been selected for the illuminating of Congress Avenue. Walter L. Eyres is city electrician.

BEAUMONT, TEX.—Work will soon begin on the extension of the street-lighting system from Forsythe to Wall Streets on Pearl Street. The Beaumont Electric Light & Power Company has the contract for street-lighting.

MART, TEX.—Steps have been taken by local business men to organize a company to establish an electric-light plant to supply electricity in the business district.

Pacific States

COLVILLE, WASH.—Harvey H. Phipps of Spokane, State Senator, is planning to establish a modern farming community in Stevens County, between Colville and Newport, covering 2020 acres of land. The plans provide for the installation of a small lighting and power plant to serve the community.

PASCO, WASH.—An agreement has been reached between the City Council and the Pacific Power & Light Company whereby the company will substitute, at its own expense, incandescent lamps of 100 cp. for the arc lamps now in use.

SPOKANE, WASH.—The contract for installing an ornamental street-lighting system on Grand Boulevard and Scott Street has been awarded to the Merchants Central Heating Company of Spokane, at $45,120.

OAKRIDGE, ORE.—The Billy Creek Mining Company, recently incorporated, proposes to supply electricity for lamps and motors and also water in Oakridge and vicinity in addition to its mining project. N. G. Hyland, Ernest E. Hyland and Charles E. McFarland of Oakridge are the incorporators.

FLORISTON, CAL.—An electric experiment which will convert the waste sulphide liquor from the Floriston mill into a commercial product will be installed into the plant of the Crown Willamette Paper Company. The electric plant was designed by Professor Bostroni, a Swedish chemist.

OCEANSIDE, CAL.—The San Diego Consolidated Gas & Electric Company has applied to the State Railroad Commission for permission to purchase the holdings of the Oceanside Electric & Gas Company and consolidate it with its own plant. The applicant states that the merger will permit it to extend its service and finance needed extensions and improvements.

SAN FRANCISCO, CAL.—The construction of a street railway (4 miles long), extending from the terminal of the proposed transpark municipal line at Fourteenth Avenue and Judah Street to Forty-ninth Avenue and Lincoln Way, thence paralleling the ocean to Sloat Boulevard, is being promoted by the Oceanside Improvement Association. The city will be asked to build the proposed railway and levy the assessment.

BOISE, IDAHO.—The Electric Investment Company has recently begun work on the extension of its electric transmission lines to new fields on the Owyhee River for the purpose of furnishing energy to private pumping plants.

ST. ANTHONY, IDAHO.—The City Council is considering a proposal for heating by electricity submitted by the Ashton-St. Anthony Power Company.

TUCSON, ARIZ.—Contracts have been awarded for equiment for the new power plant for the University of Arizona, and for 30 ornamental lamp standards for the University campus.

ANACONDA, MONT.—The contract for installing the lighting system on West Park Avenue has been awarded to J. C. Currah of Helena, at $4,320.

AUGUSTA, MONT.—The installation of an electric-light plant in Augusta is under consideration.

HARDING, MONT.—The Harding Electric Light & Power Company expects to establish a 24-hour service within the next 60 days. The company also has the contract for pumping the city water supply.

HARLOWTON, MONT.—Bids will be received by the town of Harlowton until June 15 for furnishing materials, machinery and constructing a complete water-works and sewerage system, including a motor or gasoline engine or both, pump, steel tower and tank, pumping station, etc. George E. Baker of Whitehall, Mont., is consulting engineer. S. K. Campbell is town clerk.

GUERNSEY, WYO.—Permission has been granted by James B. True, state engineer, to C. A. Guernsey of Guernsey, to construct a dam across the Platte River, near here. The cost of the dam is estimated at $250,000, and will generate about 20,000 hp. The proposed plant will supply electricity for the mines of the Colorado Fuel & Iron Company and for lighting the town of Guernsey.

Canada

VANCOUVER, B. C.—The city of Vancouver has entered into a new contract with the British Columbia Electric Railway Company for street-lighting under the terms of which the company will replace the 350-cp. carbon lamps now in use with frosted globes with nitrogen arc lamps of 400 cp. with clear globes.

ST. VITAL, MAN.—Plans are being prepared by the Department of Public Works for rebuilding the power house at the Agricultural College in St. Vital, at a cost of about $3,000.

INGERSOLL, ONT.—The Council has adopted a resolution authorizing the water, light and sewer commission to lay conduits and erect standards, etc., in connection with the installation of a new lighting system.

ORILLIA, ONT.—The by-law authorizing the transfer of the municipal electric-light plant to the Hydro-Electric Power Commission of Ontario, recently submitted to the ratepayers, was defeated. The town will now have to complete the new municipal plant at Swift Rapids, at a cost of about $90,000.

RENFREW, ONT.—The water power dry house of the O'Brien Munitions Company, recently destroyed by fire, is to be rebuilt. New conveyors and general equipment will be installed.

STRATFORD, ONT.—The R. M. Ballantyne Company is planning to construct a new power house, at a cost of $10,000, for which contract has been awarded to Pounder Brothers.

ST. FOY, QUE.—The installation of an electric-lighting system, to cost about $15,000, is under consideration by the City Council.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 28 for furnishing cast-iron lamp posts, base sockets, porcelain receptacles, transformers, panel boards, lighting fixtures, electrical attachments, conduits and fittings, lock nuts, pipe straps, solder, electric cable, wire, insulating tape, soldering paste, pipe-bending machines, cable reel wheels, etc., under circular No. 1049. For details see proposal columns.

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 16 for furnishing steel boiler tubes, steel and iron pipes, chain, steel cable, electric cable, brass tubing, cutting machines, engine lubricators, grease cups, oil cups, copper funnels, glass vault lamps, spark plugs, dry cells, etc. Blanks and general information relating to this circular (No. 1047) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA—Bids will be received at the office of the general purchasing agent, Washington, D. C., until June 10 for furnishing special round bronze, brass tubing, electric detonators, etc., under circular 1068. For further information address Earl I. Brown, major, corps of engineers, U. S. army, general purchasing officer.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Cleveland, June 27-30.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Convention, June 6-8.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General Secretary, C. E. Dustin, 62 Cedar St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. O. Oschman, Oliver Iron & Steel Co., Pittsburgh, Pa. Annual convention, Chicago, Sept. 18-22.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, E. Brettell, Electric Supply Company, Ltd., Vancouver, B. C.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, James Redpath, 505 Rialto Building, San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, C. A. Littlefield, 130 East 15th St., New York.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. E. Kearns, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia. Annual meeting, Wilkes-Barre, June 21 and 22.

ELECTRICAL CONTRACTORS' ASSOCIATION OF TEXAS. Secretary, J. H. Ashley, Fort Worth, Tex.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Hot Springs, Va., June 6, 7 and 8.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, Oklahoma City, May 23-25.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Wier, Athens, Ga.

ILLINOIS ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, C. A. Littlefield, 15th St. and Irving Place, New York. Annual convention, Philadelphia, Sept. 18, 19 and 20.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George. Houston, Tex. Annual convention, Baltimore, Aug. 22-25.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thomson, Jr., Des Moines, Iowa.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Thomas A. Wynne, Indianapolis, Ind.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Temporary secretary, E. A. Wright, Manhattan, Kan.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Herbert E. Ottenheimer, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS, ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St., New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN SECTION, N. E. L. A. Secretary. Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual convention cruise, June 20-24.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N., Minneapolis, Minn.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

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MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, New York, July 18-22.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, E. H. LaTourneau, 602 Electric Building, Portland, Ore. Annual convention, Seattle, Wash., September.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Cedar Point, July 18-21.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus. Annual meeting, Cleveland, June 22-23.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, 435 Sixth Ave., Pittsburgh, Pa. Annual convention, Eagles Mere, Sept. 5-8.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va. Annual meeting, Parkersburg, W. Va., July 13-15.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRIC LIGHT ASSOCIATION. Secretary, A. H. Savage, Dakota Light & Power Co., Flandreau, S. D.

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SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

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WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents issued May 23, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,183,870. PORTABLE ELECTRIC LAMP; H. M. Greist, F. W. Beckert and G. L. Hinman, New Haven, Conn. App. filed Sept. 23, 1915. Suction cup yieldingly mounted in base.

1,183,871. X-RAY TUBE; E. Grimes, Des Moines, Iowa. App. filed Nov. 19, 1913. Cathode rays not focused on the anode.

1,183,875. ELECTRICAL CIRCUIT; R. V. L. Hartley, New York, N. Y. App. filed Sept. 13, 1915. Greater amplification of input power obtained without resulting instability of operation.

1,183,877. ELECTROMAGNETIC REGULATING DEVICE; G. Honold, Stuttgart, Germany. App. filed April 2, 1915. Network of elastic material extending through resistance mass and capable of expansion and retraction.

1,183,881. APPARATUS FOR INTERCONVERTING HIGH-POTENTIAL POLYPHASE AND DIRECT ELECTRIC CURRENTS; C. G. Koppitz, Youngstown, Ohio. App. filed Aug. 31, 1911. Segments and brushes cooled by non-oxidizing gas.

1,183,882. MEANS FOR TRANSFERRING HIGH-POTENTIAL ELECTRIC CURRENTS IN PARALLEL EQUAL ARCS; C. G. Koppitz, Wilkinsburg, Pa. App. filed Sept. 19, 1913. Causes multiple arcs to strike simultaneously.

1,183,883. MEANS FOR TRANSFERRING HIGH-POTENTIAL ELECTRIC CURRENTS AS INTERRUPTED ARCS; C. G. Koppitz, Wilkinsburg, Pa. App. filed Sept. 23, 1913. Extinguishes the arcs as soon as distributions pass the segments.

1,183,890. ELECTRICAL CONTROLLING SYSTEM; A. E. Lundell, New York, N. Y. App. filed Nov. 2, 1914. Telephonic and signaling functions with controlling circuits extending over the two wires of each trunk.

1,183,912. ELECTROPNEUMATIC BRAKE; W. V. Turner, Wilkinsburg, Pa. App. filed July 27, 1915. Electric application effected by small size magnet in valve.

1,183,913. ELECTRIC FLUID-PRESSURE BRAKE; W. V. Turner, Wilkinsburg, Pa. App. filed July 28, 1915. Equalizing valve structure.

1,183,923. SELECTING APPARATUS; F. A. Watkins, Highland Park, Ill. App. filed Sept. 30, 1909. Automatic telephone with reduced number of impulse transmitting devices.

1,183,924. ELECTRICALLY HEATED VESSEL; W. L. Waters, Milwaukee, Wis. App. filed April 12, 1913. Heated suspended from cover and removable therewith.

1,183,925. ELECTRIC HEATER SYSTEM; W. L. Waters, Milwaukee, Wis. App. filed Nov. 13, 1913. For tank of linotype machine.

1,183,926. HEATING APPARATUS; W. L. Waters, Milwaukee, Wis. App. filed March 6, 1914. For ovens.

1,183,946. LEAK-NULLIFYING MEANS FOR TELEGRAPH SYSTEMS; J. H. Bell, East Orange, N. J. App. filed March 4, 1915. Renders effective leaks due to high-resistance grounds.

1,183,949. ELECTRIC THERAPEUTIC DEVICE; F. F. Burdick, Milton, Wis. App. filed June 6, 1914. For treating various parts of the body.

1,183,993. METHOD OF BONDING RAILWAY RAILS; J. C. Lincoln, Cleveland, Ohio. App. filed March 13, 1916. Sectional fusion in position of bond.

1,183,995. CAR-CONTROL SYSTEM; P. J. McGowan and R. J. Dikeman, New York, N. Y. App. filed Dec. 2, 1914. By which motormen on front platform of disabled car controls car pushing the same.

1,184,001. LOADING COIL FOR TELEPHONE LINES; W. Merz, Berwyn, Ill. App. filed Sept. 15, 1914. Minimizes the losses.

1,184,017. RELAY; P. M. Rainey, Glen Ridge, N. J. App. filed March 4, 1915. Improved magnet and readily adjustable armature construction for telegraph work.

1,184,020. SWITCH-STOPPING MECHANISM; J. N. Reynolds, Greenwich, Conn. App. filed Jan. 29, 1915. For definitely stopping high-speed switch carriage of telephone system.

1,184,041. SYSTEM FOR REGULATING THE AMPERAGE AND VOLTAGE OF ARC LAMP CIRCUITS; A. D. Standeford, Kansas City, Mo. App. filed Aug. 19, 1914. Especially for motion picture lanterns.

1,184,047. PUPIN COIL; E. Thuermel, Charlottenburg, Germany. App. filed May 22, 1913. Pair of coils in alternating relation.

1,184,063. PULL-SWITCH SOCKET FOR ELECTRIC LAMPS; R. B. Benjamin, Chicago, Ill. App. filed Oct. 6, 1913. Pull chain comes out at shoulder of socket shell.

1,184,090. DIRECTION-PREDICTER FOR VEHICLES; H. J. Frerks, Chicago, Ill. App. filed March 1, 1915. Employs colored lights.

1,184,091. ELECTRIC STORAGE COOKER; R. E. Frickey, Redding, Cal. App. filed May 17, 1915. Fireless cooker with water chamber.

1,184,104. ELECTRIC SWITCH; C. J. Klein, Milwaukee, Wis. App. filed April 28, 1911. Operated by double-ended push-button.

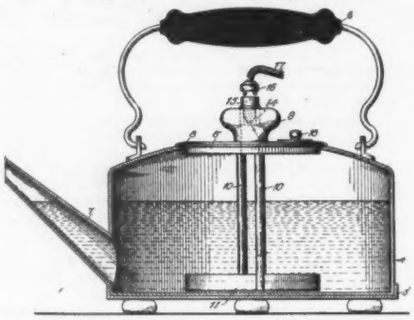
1,184,105. ELECTRIC ATTACHMENT DEVICE; C. J. Klein, Milwaukee, Wis. App. filed Nov. 20, 1911. Removable plug member operates switch mechanism within the receptacle.

1,184,109. PROCESS OF PRODUCING CALCIUM CYANAMID; J. H. Lidholm, London, England. App. filed Feb. 14, 1914. Cause carbid to react with nitrogen at temperature above melting calcium cyanamid.

1,184,134. COMBINED CAR SIGNAL AND CONTROL APPARATUS; H. Rowntree, Kenilworth, Ill. App. filed Oct. 17, 1913. Hoisting motor inoperative when a door is left open.

1,184,135. DRY CELL; J. Rudolphs, Henriksdal, Sweden. App. filed Nov. 15, 1911. Porous carbon electrode exposed to the air.

1,184,146. PORTABLE MIRROR; A. Sundh, Hastings-on-Hudson, N. Y. App. filed Dec. 16, 1914. Hand-bag mirror with electric light attachment.



No. 1,183,924. Electrically Heated Vessel

1,184,157. DYNAMO-ELECTRIC MACHINE; E. J. Andrews, Chicago, Ill. App. filed Dec. 18, 1912. Variable-speed motor or generator.

1,184,161. CONNECTOR FOR ELECTRICAL CONDUITS; H. D. Betts, Englewood, N. J. App. filed April 25, 1907. Sleeve-receiving end of armored cable.

1,184,162. SELECTOR SWITCH; G. A. Betulander, Sodertorns Villastad, Sweden. App. filed March 14, 1913. Has individual electrical magnetic driving devices.

1,184,169. ELEVATOR SYSTEM; E. L. Dunn, Worcester, Mass. App. filed Aug. 7, 1909. Automatic signaling system for dumbwaiters.

1,184,178. ELECTRICAL VAPORIZING APPARATUS; M. W. Hanks, Indianapolis, Ind. App. filed Aug. 28, 1915. Adjustable to provide any desired vaporization period.

1,184,183. SWITCH; A. A. Kent, Philadelphia, Pa. App. filed Feb. 25, 1908. Controls ignition and other circuits.

1,184,200. APPARATUS FOR HEATING WATER; J. E. E. Nash, Palmyra, Neb. App. filed Jan. 25, 1915. Transportable size—water in circuit.

1,184,217. SELF-WINDING CLOCK; H. B. Taylor, Wilkinsburg, Pa. App. filed Aug. 11, 1913. Controlled by torques of its main spring and an auxiliary spring.

1,184,224. DYNAMO ELECTRIC GEAR OF THE UNIPOLAR TYPE; M. Breslauer, Hoppegarten, near Berlin, Germany. App. filed Nov. 11, 1915. Mercury between opposing surfaces.

1,184,230. VIBRATING RECTIFIER; D. C. Davis, Swissvale, Pa. App. filed June 11, 1915. Has strong and positive starting operation.

1,184,233. RECTIFYING APPARATUS FOR ELECTRIC CURRENTS; E. Giglio, London, Eng. App. filed April 25, 1910. Vibrating polarized armature.

1,184,236. ELECTRIC HEATER FOR SOLDERING IRONS; J. T. Hawkes, Tacoma, Wash. App. filed Oct. 6, 1915. Oven structure.

1,184,244. ELECTRIC-PIANO PLAYER, WITH DAMPING DEVICE; J. F. Kelly, Pittsfield, Mass. App. filed June 4, 1914. Resembles firm and gentle touch of a pianist.

1,184,262. CONTROLLING MECHANISM FOR ALTERNATING MACHINES; C. Redfield, Ogden, Utah. App. filed Nov. 19, 1913. Starting compensator.

1,184,264. CONTROLLER FOR GROUPS OF ELECTRIC CIRCUITS FOR ADVERTISING AND OTHER PURPOSES; E. Savoye, St. Etienne, France. App. filed Jan. 14, 1915. Contact balls in rocking container.

1,184,266. VOLTAGE REGULATION; E. O. Schweitzer, Chicago, Ill. App. filed July 23, 1914. Conjoint operation of induction motor and lamp load.

1,184,273. ELECTRIC-CONDUIT JUNCTION-BOX; F. H. Terry and H. M. Bigwood, Wolverhampton, England. App. filed Feb. 11, 1913. Contractible coupling construction.

1,184,313. ELECTRICAL PLUG; D. E. Bown, Crafton, Pa. App. filed July 12, 1915. Swivel construction.

1,184,336. COMBINATION WIRE SUPPORT FOR ELECTRIC DISTRIBUTION; J. L. Fay; St. Louis, Mo. App. filed Aug. 2, 1913. Structure for mounting on poles.

1,184,376. RADIO-TELEGRAPHY AND TELEPHONY RECEIVER; G. W. Pickard, Amesbury, Mass. App. filed March 28, 1914. Employs three coils.

1,184,396. ELECTRICALLY-ILLUMINATED SHOE; J. E. Trimble, Chicago, Ill. App. filed May 20, 1914. Illuminated buckle with battery in heel.

1,184,402. SPARK-PLUG TESTER; W. S. Witter, Toledo, Iowa. App. filed Nov. 28, 1914. Spark made more readily visible by magnifying lens.

1,184,430. TEMPERATURE-CONTROL MECHANISM; A. DeKhotinsky, Chicago, Ill. App. filed June 18, 1914. Particularly for constant temperature of baths.

1,184,434. METHOD OF AND APPARATUS FOR WIRELESS TELEPHONY AND TELEGRAPHY; C. D. Ehret, Philadelphia, Pa. App. filed Feb. 3, 1909. Electric waves in groups.

1,184,454. ELECTRICAL SWITCH; B. D. Horton, Detroit, Mich. App. filed Jan. 2, 1914. Armor-clad type.

1,184,456. ELECTROCHEMICAL TREATMENT OF METAL-BEARING MATERIAL; W. H. James, Johannesburg, Transvaal, South Africa. App. filed Sept. 6, 1913. Particularly for gold and silver ores.

1,184,460. PROCESS OF AND APPARATUS FOR REGULATING SYNCHRONOUS MOTORS CONTROLLING THE SPEED OF CONVERTER COLLECTOR BRUSHES; C. G. Koppitz, Youngstown, Ohio. App. filed Oct. 10, 1912. Brushes and segments moved by synchronous motor.

1,184,461. SAFETY APPLIANCE FOR ELEVATORS; J. J. Kuntz, Brooklyn, N. Y.; App. filed Nov. 7, 1914. Door switch.

1,184,503. X-RAY APPARATUS; M. Alden. App. filed Sept. 11, 1915. Characterized by lightness and freedom of action.

1,184,520. ELECTRIC FURNACE PERMITTING THE EXTRACTION IN A STATE OF PURITY OF ZINC FROM ITS ORES; E. F. Cote and P. R. Pierron, Lyons, France. App. filed July 24, 1914. Metal separated from ore in electric furnace is refined as it is produced.

1,184,536. PORTABLE ELECTRICAL MEASURING INSTRUMENT; M. B. Kassel and A. Finkenberg, New York, N. Y. App. filed April 4, 1913. Ammeter coil operates a scale carrying armature.

1,184,539. ELECTRIC TABLE ATTACHMENT; D. H. Kendelhardt, Brooklyn, N. Y. App. filed Oct. 6, 1914. Servant calling wire connections for an extension table.

1,184,570. TROLLEY EAR; W. A. Rice, Huntsville, Mo. App. filed Oct. 7, 1914. Particularly for underground railways.

1,184,573. TROLLEY-WIRE SUPPORT; G. H. Goff and L. Rollins, Roda, Va. App. filed March 17, 1915. Operated quickly and easily to clamp the wire.

1,184,598. APPARATUS FOR REGULATING STREET TRAFFIC; J. G. Wallmann, Oakland, Cal. App. filed May 20, 1914. Piston and cylinder in connection with magnets.

1,184,597. APPARATUS FOR REGULATING STREET TRAFFIC; J. G. Wallmann, Oakland, Cal. App. filed March 24, 1914. Operated by push button.